GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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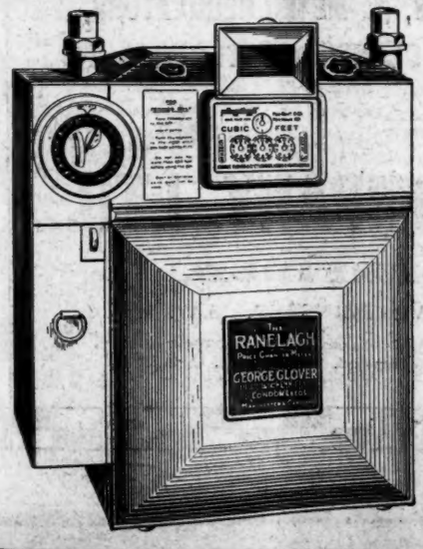

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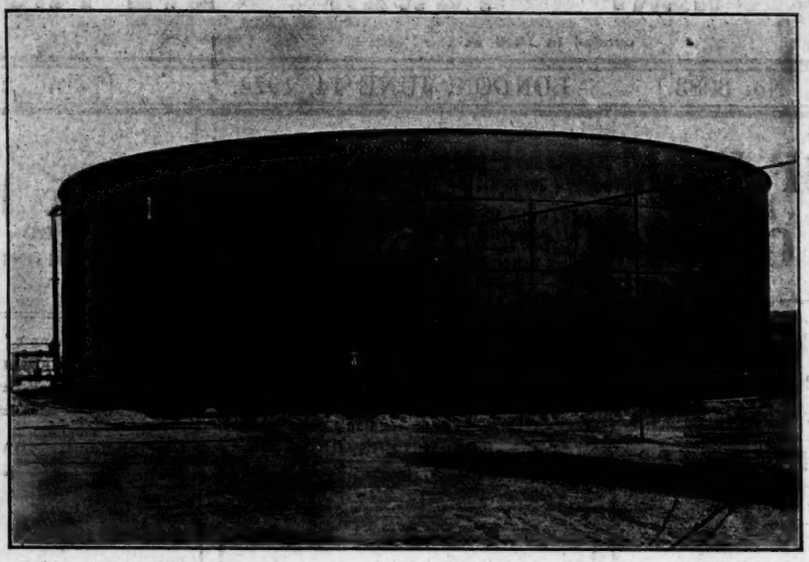

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VOL. CLVIII., No. 3083.] WEDNESDAY, JUNE 14, 1922. [74TH YEAR.

EDITORIAL NOTES.

Enrichment Gas from Low-Temperature Carbonization.

A FORTNIGHT ago we were commenting upon the report of the Fuel Research Board, in which Sir George Beilby and his staff visioned good prospects, now that gas is sold by the therm, for the rich gas from low-temperature carbonization being profitably used by gas undertakings for raising the calorific value of gas of low grade in thermal value, instead of employing imported oil. Since our comment appeared, we have had the advantage of a conversation with Mr. Walter Chaney, who is in close touch with The Low-Temperature Carbonizing Company upon the development of operations in this particular direction. It is naturally a gratification to him that the report of the Fuel Research Board should, among the many new features which it presents regarding low-temperature carbonization, have dealt with this question of the utilization for enrichment purposes of the rich gas produced. He regards it as perhaps one of the most important and progressive aspects of the report, seeing that it brings into prominence a latent but valuable use for the gas. The matter, we know, has aroused a considerable amount of interest in technical circles; and, as Mr. Chaney has been studying the subject, we propose in this article to present the position as, from our conversation with him, we understand that he sees it.

The report of the Fuel Research Board lays down as a principle, or as an ideal aim, in the carbonization of coal the production of the maximum percentage of the therms in the coal in the shape of saleable gas. In his paper on "Steaming in Vertical Retorts," Sir George Beilby demonstrates, by a description of carbonizing tests, one method of attaining the ideal—that of steaming the charges in vertical retorts with varying quantities of steam, so producing a corresponding reduction of calorific value per cubic foot of the total make. Although the Gas Regulation Act does not specify any particular calorific value, the average "declared" figure allows a limited quantity of uncarburetted or "blue" water gas to be added to the town supply. This blue gas may be produced by steaming in vertical retorts, or may be generated by independent water-gas plant. During the year 1921, many undertakings, by force of circumstances, were compelled to add large quantities of carburetted water gas to the town supply. Mr. Chaney instanced the Gas Light and Coke Company, who, in the period mentioned, added 33 p.ct. of carburetted water gas to their coal-gas output, entailing the use of 14,132,779 gallons of oil, and an expenditure of £535,000. The period was, of course, an abnormal one, covering the high prices resulting from war conditions, &c.; but it illustrates the dependence on overseas oil supplies, and the combination of interests supplying them.

Low-temperature carbonization, unlike gas oil, has the advantage of producing gas, oil, and coke. Hitherto, the rich hydrocarbon gas has been looked upon as one of the least valuable of the bye-products; but it can be readily seen that, if it can be economically produced, it is really a valuable asset as an enriching agent for raising a low-grade gas to a higher standard of calorific value. The yield of gas per ton of coal at low temperature is about 3000 to 3500 c.ft., and the calorific value 1000 B.Th.U. per cubic foot. With the ordinary high-temperature gas-works process, yielding (say) 12,800 c.ft. of gas per ton of coal and 511 B.Th.U. per cubic foot, 14·7 p.ct. of blue water gas must be added to maintain a town supply of 480 B.Th.U.

		P.Ct.
12,800 c.ft. of 511 B.Th.U. coal gas . . .	480 B.Th.U. Town Supply	= 85·3
2,200 ,, 300 ,, blue gas . . .		= 14·7

For increased quantities of added blue water gas, enrichment becomes necessary. The blue water gas may be enriched by means of low-temperature gas as follows:

		P.Ct.
1000 c.ft. of blue gas at 300 B.Th.U. . .	480 B.Th.U. Town Supply	= 74·3
345 ,, of low-temperature gas at 1000 B.Th.U..		= 25·7

Blue water gas and low-temperature gas in the proportion shown to form 480 B.Th.U. town gas cost 19·56d. per 1000 c.ft. into the holder. To produce the equivalent yield of 12,800 c.ft. of 480 B.Th.U. town gas by means of a mixture of blue water gas and low-temperature gas there would have to be used:

9510 c.ft. of blue water gas at 300 B.Th.U. . . .	= 480 B.Th.U.
3290 ,, of low-temperature gas at 1000 B.Th.U..	Town Supply.

Therefore—

		P.Ct.
12,800 c.ft. of 511 B.Th.U. coal gas . .	480 B.Th.U. Town Supply.	= 46
3 290 ,, of 1000 B.Th.U. low-temperature gas . . .		= 11 9
11,710 ,, of 300 B.Th.U. blue water gas		= 42·1
27,830		

Applying these figures to the cost of production, the report of the Fuel Research Board states that the low-temperature gas could be supplied at 4d. per therm, with a yield of about 3000 c.ft. of 1000 B.Th.U. gas. This is equivalent to 3s. 4d. per 1000 c.ft. into the gasholder. The South Metropolitan Gas Company produced, in the year 1921, 12,711 c.ft. of straight coal gas per ton of coal carbonized; the calorific value being 550 B.Th.U. per cubic foot. The cost was 34·72d. into the holder. The Gas Light and Coke Company in the same period made 12,194 c.ft. per ton, and added 33 p.ct. of carburetted water gas. The cost of the mixed gas was 39·49d. per 1000 c.ft. Assuming the cost of blue water gas over the same period to have been 18d. per 1000 c.ft. into the holder, and that 12,800 c.ft. of 511 B.Th.U. gas could have been obtained from the coal, bearing in mind the result obtained by the South Metropolitan Gas Company, then:

		P.Ct.	Pence	Pence per 1000 C.Ft.
12,800 c.ft. of 511 B.Th.U. coal gas		46·0	of 39·49 =	18·36
3,290 ,, 1000 ,, low-temperature gas		11·9	of 40·00 =	4·76
11,710 ,, 300 ,, blue water gas . .		42·1	of 18·00 =	7·56
27,800 ,, town gas of 480 B.Th.U.				
Cost of 1000 c.ft. of 480 B.Th.U. town gas				30·68

These figures may be left to the consideration of readers.

The report of the Fuel Research Board also states that it may be assumed that the price obtained for the coke as a high-class domestic fuel will be sufficient to meet the entire cost of the coal used in its production; and the crude oils amounting to 14·5 gallons can be sold at an overhead price of 5d. per gallon. The disposal of the "coalite" or smokeless fuel to the extent that it will be produced should present no difficulty to the present-day expert coke salesman. Prejudice against the then newcomer existed some years ago when the bye-product coke-oven was introduced;

but it prevailed through the superiority of the coke made as compared with the "beehive" material. In a minor degree the same prejudice existed on the introduction of coke from the vertical retort. Now on the authority of the Fuel Research Board, Sir George Beilby, and others, there should be little difficulty in establishing a market for what Sir George is satisfied is an excellent domestic fuel. But the use of the rich gas as an enricher of low-grade calorific value gas is what interests us to-day.

Chief Gas Officials as Directors.

WE have always held that, when a chief official has spent practically the whole of his working life in the service of a Company, retirement from executive responsibility should simply mean translation to the Board. This particularly applies to technical gas officials. We have seen much good resulting from it. The trained officials—whether on the technical, commercial, or financial side—are the men who know more about a concern and its requirements than those ordinary directors can possibly know who are elected by the shareholders to carry on the administration, without much knowledge as to their qualifications for the position. Men who have lived in the work are the ones who have the greatest knowledge of it. The South Metropolitan Gas Company have made the qualifications of Directors a matter of statutory enactment. They have long held the view, and have put it into practice, that Directors should be men of special technical or other qualification. The President of the Company (Dr. Carpenter) and Mr. Frank Bush are old officials. In the Company's Act of 1921, it was provided that: "All Directors of the Company elected after the "passing of this Act shall be persons possessing profes- "sional, technical, commercial, financial, or scientific know- "ledge advantageous to the conduct of gas undertakings. "The Chairman of the Board of Directors shall be desig- "nated the President of the Company, and the Deputy- "Chairman of the Board the Vice-President of the Com- "pany; and they shall both be persons having substantial "practical or business experience in the production and "sale of gas." The Governor of the Gas Light and Coke Company (Mr. D. Milne Watson) is an old official of that great concern; and Mr. Thomas Goulden, who has lately been elected to the Court of Directors, having for many years served the Company as Chief Engineer, shows again how training and experience are now valued in helping in administrative work. Several years ago the Commercial Gas Company elected their old Chief Engineer and General Manager (Mr. H. E. Jones), and later the Secretary (Mr. H. D. Ellis) to seats at the Board. Mr. Jones, despite his years, is still "going strong" as a gas administrator. The examples might be multiplied. To-day it is our pleasure heartily to congratulate Mr. A. E. Broadberry, M.Inst.C.E., the Chief Engineer and General Manager of the Tottenham District Light, Heat, and Power Company, on his election to a seat at the Board. He will (it is seen from information in our "Personal" notes) retire from his present official position at the end of this month, after 43 years in the Company's service. By good work he has won the honour now conferred upon him; and the position of the Company to-day is witness to the success of his professional labours.

Strictures from the Welsh Meeting.

WHEN preparing the Presidential Address that he delivered to the Wales and Monmouthshire District Institution last Thursday, it is evident that Mr. James Robb, of Chepstow, was out to speak his mind; and he spoke it. He chastized many people from the Government, the Royal Engineers, and the Office of Works, along to the manufacturers of gas plant and appliances, and there was some criticism of the methods of the British Commercial Gas Association. Some of the strictures were richly deserved; others were not. All that he said about the Government cannot be denied. He spoke from direct experience; and his experience is an illustration of muddle and waste on the one hand, and the niggardliness on the other, of the Government and certain of their departments during the war years. The history of the war is a history of inversions. The gas industry was pressed for the wherewithal to make the munitions without which the war could not have been won; but all that could be obtained from the Government as payment for those necessaries was a poor requital for the services rendered, and for the defamation of reputation that the gas industry suffered among its patrons. Gas consumers, too, were asked to use as much gas as they could in place of coal, so as to give larger scope for the production of those necessaries. But while there was parsimonious treatment of the industry, Mr. Robb had before his eyes in the notorious Chepstow national shipyards one of those many ghastly examples of ill-conceived war schemes and squandering of the substance of the nation. Much more money was wasted in this and other ways than would have satisfied all the claims of the industry to a just recompense for services rendered.

Then there was the spectacle of Government departments working athwart each other. While consumers were asked to burn as much gas as they could instead of coal, in order to enable a larger production of necessaries for the war, in almost every building the Government took over in Chepstow, the unwise men of the Royal Engineers and of the Office of Works took it upon themselves to rip-out the gas-fittings and substitute electricity; thus doing precisely what the Explosives Supplies Department did not want them to do—reduce the scope for gas output. Apart from this aspect of the matter, the very substitution caused an unnecessary waste of money. The blundering went on. Lord Moulton generously praised the gas industry; electrically trained engineers employed by the Government used their temporary acquisition of power to deprive gas of its due, and to give to electricity. Mr. Robb has good cause to feel sore over all that was done. Electricity was pampered in every way. He also tells how money was spent on the erection of a super-electricity station—the amount of the expenditure nobody knows; and at present all the revenue derived from the sale of current does not pay one-twelfth part of the wages. Then an extension of gas supply was required to outside areas. Mr. Robb, seeing how things were being managed, specified that the work should be executed under his direct supervision and control. This appears to have been sufficient to turn the work and business over to the Electricity Supply Company, which as yet (so it is understood from the address) has not been asked to pay a penny, though deriving revenue from the supply. Now one by one the consumers are discontinuing the use of electricity; and are clamouring for gas. Thus the Gas Company have to compete with what is tantamount to subsidized electricity. The indictment is a serious one; and the injustice of it all needs no elaborating words to drive it home. The nursing of electricity by the Government is still being continued, as is evidenced by the Electricity Supply Act of 1919 and the supplementary Electricity Supply Bill now in Parliament, which, combined, are to promote schemes that high-placed electrical and financial judgment has condemned. The castigation that Mr. Robb has in his address given to the Government and the wartime Departments which were responsible for an enormous loss has full warrant in the Chepstow experiences. Chepstow is a name to-day that does not bring any delight to the Government, when the hideous waste and administrative transgressions there are brought forward by critics.

Coming to the other strictures, we do not think they are deserved in some cases; or if in any way deserved, not with the intensity with which they are presented. The manufacturers of gas plant and appliances are charged with having got the fever for charging outrageous prices, and "having "got the fever," they acted accordingly. By contrasting their price increases with the advances that they had to meet in the costs of materials and labour, it seems to us that those who assail with severity do so without any complete knowledge of the facts. Then, again, the gas-engine makers are charged with paying much attention to the production of large gas-engines (so assisting the electricity industry to compete against the gas industry), while they should be giving attention to the production of small gas-engines, and trying to make them self-starting. We have yet to learn that it is a positive fact that they have been neglecting the small gas-engine; and as to large ones, where there is a demand for them, they must meet it, or foreign makers will do so. While we sympathize with much that Mr. Robb says, it is no use allowing feelings to outstrip discretion and fairness. We ourselves are of the opinion that the gas-engine makers have not worked with the gas industry with the intimacy that they might and should have done. We have on occasion appealed to them to rectify their attitude, but so far without much avail.

Reverting to the plant manufacturers, Mr. Robb also asserts that the plant that is now being turned out is not

coming up to the standard claimed for it; and in many instances all sorts of alterations have to be undertaken to get it to work to anything like the merits claimed for it. Mr. Robb is very emphatic about this; and for it he says there is a reason—that the manufacturers do not come in contact with gas engineers often enough to talk-over matters. Whose fault is this? When the technical men on the manufacturing side are kept by those in high places in the industry at a distance from the engineers on the gas-supply side, and not allowed to enter into common association with them except by invitation, it could not be wondered at if they were not *au fait* with the internal operations of and advances in the producing and other processes of a gas-works. The surprise to us is that they are as well informed as they are. But is all the censure really deserved as to plant not coming up to the standard in results? We do not think it is; and, in fact, we know it is not when daily we see plant exceeding its guarantees in performance, and plant that can be regulated to meet the varying conditions between one district and another, and between one class of coal and another. Therefore we cannot admit that Mr. Robb's sweeping indictment is justified. There is complete agreement with him that we must draw closer to the chemist, and the chemist to us.

Then the British Commercial Gas Association received a little flagellation. There seems to be some contradiction in the allegations. It is admitted that the Association are progressive; but in the view of Mr. Robb, they have not changed in the right direction. He seems to think they have neglected lighting, which is the staple business after all of many gas undertakings. He is apparently of opinion that their advertising schemes are not on right lines; and that they should resign some of their expensive methods—such as conferences and whole-page advertisements—and expend the revenue in advertising on a smaller scale in papers all over the country. We have heard private criticism on much the same lines—especially as to a waning of advertisement in the public Press. We have no means of testing this complaint. Again, only recently a prominent man in the gas industry suggested to us that, in his opinion, there were ways and means by which the Association could effect economy, and utilize the savings to more profitable publicity advantage than at present. What he particularly had in mind was the expenditure on the "Bulletin" and some other printing—his view being that most of the communications it was necessary to make to the subscribers could be through the channel of the Technical Press. We should be only too happy to do our part, if the Association thought it desirable to cut-down expenditure in certain present directions, and utilize the money in other ways. The private critic pointed out that, so far as his undertaking was concerned, its subscription was intended for publicity and educational work among the public, and not for spending on literature to distribute among the subscribers themselves. These are matters which it would not be at all a bad thing to investigate. We all admit and admire the hard and (much of it) well-devised work of those engaged in the Association. But it is a large spending department of the industry; and it would be well to pause occasionally, and scrutinize what is being done in order to give an answer to the questions, "Is all the money subscribed being expended in the manner best calculated to produce the subscribers' desired and designed results?" "Does it meet with the universal approval of the subscribers?" "If not, what are their objections, and are they valid?" There were other points. One referring to the work among architects. With the criticism in this direction we are in hearty disagreement. Mr. W. M. Mason, Manager of the Association, was fortunately present at the meeting; and it will be seen that he dealt with the presidential criticisms so far as his organization is concerned.

A remedy for improving matters was suggested. Mr. Robb believes that everybody in an electricity undertaking—from the top to the office boy—is a sort of missionary for the business. The electricians will not agree. They have not discovered this general desire to assist in the work. At the same time, a general enthusiasm among all interested in a business is a good thing—whether directors, shareholders, staff, or other employees. This led on to the view that what is required in the industry is a national organization very much on the lines lately proposed by Sir Arthur Duckham. We will leave the matter there (as we think the address will be somewhat widely read) in part with agreement; in part, otherwise.

Work of the Managers of the Smaller Gas Undertakings.

THE past few years have been not only of considerable educational value to the gas industry, but have brought out latent energy and skill of no mean order, of which the technical men of the industry have shown themselves to be possessed. They have met difficulties of a stupendous and unprecedented character; they have had their periods of grave anxiety, and have passed through them with fine virility. Nothing similar has ever been experienced. The waves of stress, perplexity, and solicitude succeeded one another year after year. But they were surmounted one after another until at length one was almost tempted to ask whether there were really any limits to the vitality and endurance of the industry itself and of its men, because both were subjected to unparalleled conditions of operation and obligations which are not the experience of other commercial industries. Matters, however, are now smoothing down, and becoming more composed; and it appears as though the end is being reached of those great labour upheavals that have so seriously and so long obstructed our industrial rehabilitation. Now we are looking forward to a brighter future, in which it is hoped that men will find greater mutual interest, and discard the belief that interests are antagonistic. However, we have just been reading a passage with which there is hearty concurrence: "It is a glorious privilege to have seen and lived through "the intense trials of our nation, and as an industry to have "taken some little share in the stupendous efforts that the "nation has been called upon to make in recent years." These words are in the inspiring address that Mr. Alex. Dow, of Galashiels, delivered at the meeting of the Waverley Association of Gas Managers last Thursday. It is true that it has been a glorious privilege, though one which would have been better had it not been necessary. But after all, good has sprung from it in the direction of revealing a higher standard of power not previously suspected; and this standard of power should be applied to our future industrial doings. It may be—in fact, it is true—that during the war and the coal strike, when the nation was saved by the gas industry from a famine of heat agents in respect of food preparation and hot-water supply, the industry and its men were more abused than thanked for what they did in the public service. But there is always the gratifying knowledge that the best was done, and that the gas undertakings of the country successfully stood between the people and the possible effects of a complete cessation of supplies of solid fuel.

The address of Mr. Dow is suggestive; and it is full of discussable point. Among other things, it illustrates ways in which the managers of the smaller-sized undertakings may do additional effective work for them. One suggestion has reference to the combating of the unfair criticism to which the industry has been exposed in the Press—particularly regarding complaints as to "bad" gas. Some gas managers and other officials think it sufficient to deal only with the complaints that are directed to them; but the people who think, through misunderstanding, that they have grievances, and yet do not openly complain, preponderate in number. These have to be met. Mr. Dow asks how this can best be done. He has replied by telling us the course he himself has taken. He is no armchair gas manager. He has gone personally to the consumers, and has lectured to a large gathering of them. He explained to them in simple language the processes of manufacture, and the many uses of gas for domestic and industrial purposes. By practical experiments he demonstrated the many causes of so-called "bad gas," which should be properly described as misuse. He showed the importance of employing proper appliances and of adjusting them, and how to use gas to procure the best service. There is nothing so convincing that it is not the gas that is "bad," but the appliance or the adjustment, as a demonstration of misuse and proper use with the same gas. We have done it when neighbours have complained of "no heat" from their gas-fires, by showing them fires burning properly, and using gas from the same street main. Mr. Dow found that his lecture had the immediate effect of dissipating much of the evil engendered by false reports and ill-conception; and this, in his opinion, is the best and most efficacious way of dealing with such a matter. The most effective corrective of slander in the case of gas is the education of the consumers themselves; and all valid means should be taken to accomplish this. There

is the admirable work of the British Commercial Gas Association. But that work, carried on in many avenues though it is, does not fill the requirement. It needs a supplement; and Mr. Dow thinks this work is "not efficaciously "backed-up by the industry, and individual effort." That "backing-up" and that "individual effort" are highly important; and they are what are necessary to make the work of the "B.C.G.A." complete. Where there are not those local finishing touches, the work of the Association loses a considerable measure of value.

There is another thing the technical men of the industry should see is done. It is to assure (so far as control is in the hands of gas undertakings) that consumers are supplied with appliances that are the most efficient obtainable, and that those that are efficient are used in the way that will give the consumer the best return in duty of which they are capable. If technical men do not do their part in this direction, then they themselves supply another instance of incomplete work. Appliances differ very widely in efficiency; the consumers gain or suffer accordingly. Mr. Dow has proved it by his investigations with three types of boiling-rings. The gas was of a calorific value of 475 B.Th.U. To boil a quart of water, in one case 673·5 B.Th.U. were used; in the second case, 719·5; and in the third case, 997·5. In the third instance, about 48 p.ct. more B.Th.U. were required than in the first case; and the efficiency was only about 41 p.ct., compared with 61 p.ct. The consumer purchasing on the therm basis is day by day wasting gas, and so money, if he is using inefficient appliances, or improperly using (through ignorance) efficient ones. Just think! A 20 p.ct. difference in efficiency means that for all purposes for which the inefficient appliance is employed, the consumer is paying heavily for wasted B.Th.U. Realizing the highest efficiency may be more valuable to the consumer than a reduction of price. Then, again, Mr. Dow instances a firm who were using a gas-engine, and at the same time spending about £60 a month on fuel for heating water. He was able to point out that by utilizing the waste heat of the gas-engine, about 50 p.ct. of the water required could be obtained. The gas manager, it is abundantly clear, should interest himself in the doings of his local industrial consumers if the undertaking is not one that is large enough to keep a technically qualified sales manager.

There is the Gas Regulation Act; it has imposed fresh duties and obligations upon the manager. Among other things, he has to settle the question as to what, in the circumstances of his individual plant, coal, and other local conditions, is the best calorific value to declare. Mr. Dow has evidently determined the matter by trial. He has found that 475 B.Th.U. gas is preferable even to 500 B.Th.U. gas. His figures show that he has also discovered that it does not always do to increase the make of therms per ton beyond a given point, as it may turn the economic balance the wrong way. Take a 410 B.Th.U. gas—he is able to produce per ton of coal 78·2 therms; but at a manufacturing cost of 2·57d. per therm. Of 475 B.Th.U. gas he is able to produce 76·8 therms per ton, at a manufacturing cost of 1·66d. per therm. Of 500 B.Th.U. gas, he is able to produce 65·7 therms per ton, at a cost of 1·97d. per therm. What is the good in his case of the high volume of 410 B.Th.U. gas when he has only 1·4 therms more for sale per ton than when making 475 B.Th.U. gas; and it costs about 6s. more per ton to produce the addition? And why under his conditions lose 11·1 additional therms by making 500 B.Th.U. instead of 475 B.Th.U., particularly when the manufacturing cost of the latter is 0·31d. less per therm. Mr. Dow has discovered by trial his economic level. The experiment with each quality of gas lasted a month; and he asserts that he had more complaints with gas of 500 B.Th.U. than when a lower quality was being supplied. Was this due to want of proper adjustment?

One other matter. Mr. Dow touches upon the question of compiling statistics as to the calorific value, composition, and ash content of gas coals in different areas, based on recent and authoritative analysis. He, like others of late, urges that this would be of inestimable value to the manager of the smaller works. But the information could only possibly be of the most general character, in view of the fact that the different bands of coal constituting a seam often vary considerably in all the respects mentioned, as well as in that important one of fusibility or infusibility. The idea is far from being the simple thing that it appears to those who have not investigated what it actually means. Mr. Dow throws out the suggestion that the work—we take it from analyzing to compilation and publication—should be undertaken by the National Gas Council and other associated bodies, with the fixed conviction that, if it were, it would constitute a great step forward in the ultimate progress of the industry. The resulting tables could be revised (say) every five years; and this would give the gas manager a definite basis on which to chose and purchase his coal. It might be of some assistance, but not completely reliable. Nor could the information be compressed into a "table" of reasonable size. But we do think, if a Committee of technical men in each coal area undertook the work, it might be possible to compile a handbook containing a large amount of useful information, though it might not be dependable over any length of time. These are some of the matters treated upon in the address, which included testimony to the flexibility and good operation of the Dempster-Toogood continuous vertical retorts, with information showing the need of having the producer furnaces modelled to suit Scotch coke, which has characteristics dissimilar to those of English coke. There was heavy work with clinkering when the installation was started at Galashiels; but remodelling (as explained in the address) has absolutely eliminated the formation of clinker in the producers.

Return of the Meter Men.

As a result of the favourable ballot in respect of the acceptance by forty-five unions of the engineering employers' revised terms, nearly all the shops of the meter makers had their full complement of men at work last week after the lock-out; and both employers and employees are relieved that the anxiety of the past few weeks is over. At one or two works it is understood there was a little difficulty. But negotiations were immediately commenced with the unions; and the matters in question have probably been already adjusted. At any rate we hope so.

A Fellowship and a Scholarship.

In the advertisement columns last week, there were two notices from the Department of Coal Gas and Fuel Industries of the Leeds University. To them the attention of the students of the art and science of gas production and use, and the younger aspirants to position in the gas industry, may be specially directed. The first advertisement invited applications, up to June 19, for an open fellowship of £200 per annum. This fellowship was established by the Institution of Gas Engineers for the prosecution of post-graduate research in gas chemistry. The second advertisement refers to the Corbet Woodall Scholarship; and we want to point special notice to this, for two reasons. The first is that it affords an excellent avenue of entrance to the profession of gas engineering; and the second is that unfortunately last year it was impossible to award the scholarship, because no candidate of sufficient merit presented himself. It seems to us that it is rather a reproach to the profession, and to the candidates for positions in it, that this scholarship should go begging. The scholarship is of the value of £60 a year, and tenable at the University for three years, with power of extension for a fourth year. It is offered for competition by candidates desiring to enter the University in October, 1922; and applications (directed as intimated in the advertisements) must be submitted not later than next Monday, the 19th.

Coal for Tully Plant.

In an article in another column, Mr. C. B. Tully discusses the question of the selection of coal for use in the gas-producing plant bearing his name. The conclusion come to is that with quite a second-class coal it is possible to obtain the best all-round results. It is obvious that this offers a wide range of the cheaper coals from which to make selection. It is better to avoid a highly bituminous coking coal, on account of its liability to stick and form a pasty mass in the generator, and generally to give difficulty with clinker.

Exhausting Union Funds.

The mistakes of trade unions are expensive matters. We saw this in the coal strike, when a staggering sum was lost by the country and the mining and other industries. Miners' Unions also reduced themselves to a poverty-stricken condition. It is a good thing the engineering lock-out is drawing to an end—a lock-

out that need not have taken place if men had only realized that employers have rights as well as those they employ. The General Secretary of the Amalgamated Engineering Union (Mr. A. H. Smethurst) has, referring to the serious drain on the finances of the Union through the dispute, announced that on the general fund there is a deficiency of £1,250,000, and on the contingency fund a deficit of over £200,000. These are big and unpleasant figures for the members to contemplate. At the biennial congress of the National Union of General Workers, the Council called attention to the serious situation arising from the heavy expenditure caused by the recent prolonged disputes. It was mentioned, as an example, that throughout the engineering trouble the Union had been paying-out an average of £15,000 a week. With this and the wearing-away of funds through unemployment benefits last year, a review of the financial situation was necessary. Recuperation is proposed by increasing members' contributions; and the officials have volunteered to submit to a reduction of their salaries by £2 a week.

Amalgamated Engineering Union Ballot.

In conformity with the resolution passed by the delegates of the "A.E.U." at their recent meeting at York—that a ballot of the members should again be taken on the employers' terms relative to the question of works' management—last Wednesday some 400,000 ballot-papers were distributed; and they were returnable last Monday. The papers were accompanied by a strong lead by the President (Mr. J. T. Brownlie) in favour of acceptance, though the principles as originally put forward by the employers have not been altered. It is, however, regarded as important that the employers have agreed to give at least ten days' notice of any change that is calculated to result in one class of workpeople being replaced by another. In our opinion, a stronger reason for advising acceptance is found in the straitened financial position of the Union as disclosed in the preceding paragraph. The result of the ballot was announced yesterday; the figures in favour of acceptance being 75,478, and against 39,423.

Miners' Wages.

According to the report received by the Executive of the Miners' Federation last week, a serious position exists among the miners owing to trade depression and reduced wages. The information was to the effect that several thousand miners are now working short time, and are forced to eke-out an existence by receipt of poor-law relief. Wages in some parts of Northumberland and Lancashire, it is declared, have fallen to starvation level, while the conditions prevailing in South Wales are also reported to be causing anxiety. What part did the three months' stoppage of output last year have in producing these effects?

Railways and Motor Transport.

We have been taking some interest in this subject; and to bring to a close previous references, it may be mentioned that, in view of evidence tendered by the Ministry of Transport, the Midland and North-Western group of railways decided on Monday to abandon their Bill by which they sought to engage in road transport.

45th Congress of the Société Technique.

The 1922 Congress of the French Institution is to be held this year in Paris, at the Civil Engineers' headquarters. It opens at 9 a.m. on Saturday, June 17, with the business meeting. The President will give his address after luncheon, and this will be followed by the announcement of prize-winning papers and the distribution of decorations. There will be a banquet in the evening. On Monday and Tuesday the various Technical Commissions will submit their reports, and members their papers, to be followed by a session for discussion. On Wednesday the guests of our Institution leave for London. Thence they may return direct or by way of Belgium; or those who are unable to visit London may go direct to Belgium on Saturday the 24th. During the Congress there will be an exhibition of appliances. It should be a most enjoyable meeting.

Tests on Ranges and Cooking Appliances.—We have received from H.M. Stationery Office the Fuel Research Board Special Report No. 4. This deals with tests on ranges and cooking appliances by Mr. A. H. Barker, Wh.Sc., B.A., B.Sc. The price is 2s. 6d., or by post 2s. 8½d.

PERSONAL.

To fill the vacancy on the Board of the Tottenham District Light, Heat, and Power Company—resulting from the recent death of Sir Daniel F. Goddard, and the election of Mr. Henry Woodall to the Chairmanship—the Directors have appointed Mr. A. E. BROADBERRY, who will retire from his present position of Chief Engineer and General Manager at the end of this month. Mr. Broadberry, who is a member of the Institution of Civil Engineers, has been for over forty-three years in the service of the Tottenham Company, having been apprenticed in May, 1879, when the make of gas at Tottenham was 138 millions. Continuing with the Company as Engineering Assistant and Assistant Engineer till October, 1899, on the death of his father (Mr. W. H. H. Broadberry) he was appointed to the chief position after twenty years of service. The make of gas was then 576 millions, having increased four-fold. During the 23 remaining years as Chief Engineer and General Manager, the make of gas has reached 2880 millions, or a further five-fold increase. In addition to this, the electric lighting in Wood Green has been added to the Company's business, as well as the undertaking of the Enfield Gas Company.

The recent King's Birthday Honours list included a Knighthood for Mr. ROBERT SEPTIMUS GARDINER, Editor of "The Near East," a publication much valued in Egypt, Palestine, and the East, and Manager of important collieries and shipping undertakings in the North of England. Mr. Gardiner is well known to the gas industry, in which he has considerable interests. He was predecessor to Mr. R. W. Wilson as Secretary of the Imperial Continental Gas Association, and later succeeded Sir Corbet Woodall as Chairman of the British Gas Light Company.

Mr. WILLIAM CASH has been re-elected President of the Institute of Chartered Accountants, and Alderman EDWARD CECIL MOORE Vice-President, for the ensuing year.

Mr. R. H. BROWN, whose resignation of the position of Gas Engineer to the Birkenhead Corporation was announced in last week's issue of the "JOURNAL," has commenced business on his own account. He is in touch with many of the leading collieries, and is acting for a well-known firm of gas-plant manufacturers, as well as being prepared to make offers for residual products. Pending the completion of arrangements for suitable office accommodation in Liverpool, communications should be addressed to him at No. 13, Caroline Place, Claughton, Birkenhead.

Mr. KENNETH M. CHANCE, the Chairman of the Gas Committee of the Oldbury District Council, after moving the adoption of the Committee's report at a meeting on Wednesday last, tendered his resignation as a member of the Council, and left the chamber. It appears that he was a member of a Sub-Committee formed two months ago for the purpose of endeavouring to obtain a reduction in the rates; and his resignation was a protest that no information had been given, and nothing had been done.

Preventing Spontaneous Combustion of Coal.

Writing in the Empire State Association (U.S.A.) "Bulletin," on precautions that should be adopted to prevent bituminous coal taking fire, Mr. W. H. Carpenter says the danger is considerably greater in the poorer than in the better grades of bituminous and semi-bituminous coals, though there does not appear to be any satisfactory method of telling by inspection how deeply any of them may be stacked without the certainty of self-ignition. The storage in one pile of several kinds or grades of coal may be counted on to produce a dangerous degree of heat wherever the pile may reach any considerable depth. The secret of success would seem to lie in two basic principles which, if followed out, will reduce to a minimum the likelihood of the coal actually taking fire. These are: Do not store bituminous coal to a depth of more than 12 ft., or make the pile more than 40 ft. wide at its base. Limitation of stocks to these dimensions will be found to eliminate 90 p.ct. of the trouble from this cause. Do not let the air get at the interior of the pile. For this reason, it is very desirable to pile coal so that the lump and finer sizes are distributed as uniformly as possible. Do not let all the lumps roll down from the top, and then pile them up in a nice open-work wall which will form air-passages into the base of the pile. If practicable, store only screened lump coal, and avoid unnecessary handling and breakage. Never keep soft coal near external sources of heat, and avoid alternate wetting and drying. Do not leave any coal in the pile longer than is necessary. Vigilance in locating and in detecting zones of heat, and the prompt removal of the coal, is the best way to combat spontaneous combustion in piles which, either by oversight or by necessity, have been built-up to a dangerous depth.

"Electrician" Annual Tables.—We have received from Messrs. Benn Bros, Ltd., the "Electrician" Annual Tables of Supply Undertakings for 1922. The price is 10s., with 9d. extra for postage. This useful work has been completely revised; and particulars of generating and converting plant, mains, motor hiring schemes, oil fuel, showrooms, &c., have been included. Many new undertakings have been added; and the list of supply stations in the British Empire is now comprehensive. Some new foreign concerns have also been included. The new form observed in presenting the statistics permits of addition as circumstances warrant; and the Tables should become increasingly useful to engineers, manufacturers, suppliers, exporters, &c.

ELECTRICITY SUPPLY MEMORANDA.

RECENT mention was made of the fact that the London County Council had entered into an arrangement with the Shoreditch Borough Council for the supply of electricity for lighting twelve dwellings—the current to be used, when not required for lighting, for heating water for domestic purposes. Of course, there is scant revenue from the lighting of apartments and small houses—so scant that often it does not justify the capital expenditure involved; and so the custom in such places is found to be a losing game. It seems that Mr. C. Newton Russell, the Borough Electrical Engineer, has been investigating the matter; and he has come to the conclusion that, by combining domestic hot-water supply for the smaller purposes—not for baths, &c., but washing-up, and so forth—there is business to be done that will pay the consumer and be remunerative to the undertaking. That is the conclusion. The actual success is a matter for trial, and so is the degree of adoption. The system is already on offer to the tenants of three rooms, at a cost of 1½d. per unit. The "Electrical Times" has published a description of the system; and from our contemporary we extract the details given here. The supply of current for lighting is at the base of the business. When the current is not being used for lighting, it is switched-off for water heating. The case is instanced of a three-roomed flat requiring three lights of 30 watts each, or 90 watts in all. From this it is seen that, given one 30-watt lamp to each room, it is intended that the illumination shall be of very modest amount. There is also supplied a 4½-gallon cylindrical water-tank, fitted with an electrical heating element wound in three sections of 30 watts each. By simple two-way switching, it is possible to give a twenty-four hour supply at a fixed maximum demand—in this instance, 90 watts, which is equal to 2160 watts per twenty-four hours, and for the week 15·12 units. The water in the heater reaches a maximum temperature of 140° Fahr. By an attachment fitted to the heater, the action of turning the tap to draw-off hot water controls the ball valve, and prevents cold water running in from the house water-main until the tap is shut-off. The charging for this service at power rates means an expenditure of (say) 2s. per week. A separate supply is given for cooking purposes at 2d. per unit. It is not claimed that this solves the problem of electricity supply to small houses, but that as an experiment it is a step in the right direction. Calculation suggests that the heat losses must be considerable; and it is quite obvious they must be during night time. If there were no heat losses, and the heater had 100 p.ct. efficiency, to raise 4½ gallons of water to 140° Fahr., 4140 B.Th.U. would be required, or 1·2 units. No heater of the kind, supplied with heat by the trickle method, can have 100 p.ct. efficiency. There are bound to be considerable heat losses, so that the consumption per 4½ gallons of water heated to 140° Fahr. would be much more than the 1·2 units; yet the total allowance of current is only, in the instance quoted, 2·16 units per day. By the way, who pays for the installation? It is clear it cannot be included in the 1½d. per unit.

Combination Lighting and Hot-Water System.

Since the passing of the Electricity Supply Act of 1919, hiring out of electrical appliances has been tentatively taken up here and there; and the system is spreading. Glasgow has spent money on the purchase of—is it 400?—electric-cookers, and the Winchester Corporation decided to dabble in a like venture recently, but only to the extent of £250. In December last, the Hammersmith Borough Council decided to spend £200 on the purchase of fans, irons, radiators, and other small electric appliances for hiring-out purposes. We do not suppose the £200 bought many examples of each of these things. Now the Engineer has advised that there should be a development of this branch, and so the Council have allocated an additional £1000 to the purpose. Several other authorities have been making similar movements. It is obvious that they are doing so with a great deal of caution. They have good reason, in view of the pretty general complaint that maintenance costs have after a bit a disposition to struggle with the rentals for supremacy, which does not assist to make the hiring-out business a good self-supporting proposition. Besides this, very high maintenance costs generally mean troublesome experiences by the users, which is not good for the quick development of domestic electrification. Most gas undertakings who were successfully developing the hiring-out business before the war, but discontinued it during the period of peak prices for appliances and labour, have now restored the system, or have established the next best thing—hire-purchase. But simple hire is the more popular, where rentals are moderate. There has, however, been a disposition on the part of some gas undertakings to put-up rentals to a figure which compares badly with pre-war charges. Consumers are very prone to test whether a thing is expensive nowadays by comparison with pre-war figures; and, though we are not favourable to business being done at a loss, we know that rentals that look heavy are an obstacle to progress.

Hiring-Out.

Many of the smaller electrical articles that are let out on hire are connected-up to the lighting circuits, and so their consumption is charged at lighting rates. During the recent hot weather, the advice was strongly tendered that electrical retailers should make a speciality of electric-fans. In one note on the subject before us, we see the hire-purchase of fans is advocated. It is pointed out that, if the retail price of a fan is £5, the cost to the retailer would be about £3 10s. Supplied on the instalment plan, the £5 would be liquidated in twenty weeks at the rate of 5s. a week. A small fan with an approximate consumption of 32 watts could be run for thirty hours with the expenditure of a unit of current. The writer deplores the fact that "power" rates for domestic electricity have ascended beyond 1d. But these things are mostly connected up to the lighting circuit; and charges of 10d. and 1s. obtain as lighting rates. Taking a larger desk or bracket fan having blades 16 in. diameter, with a consumption of 75 watts, it can be run for ten hours for ¾d. with electricity at 1d. per unit; or for an hour and a quarter for 1d. with electricity at 10d. per unit. Coming to exhaust-fans (which, performing heavier duty, consequently take more energy), the cost for a 36-in. alternating current fan, taking 600 watts, would be 3-5ths of a penny per hour with electricity at 1d. per unit, or 6d. per hour at 10d. per unit. The running of such fans is a fairly expensive matter operated off the lighting circuit. A correspondent of "Electrical Industries" has something to say about the electric fan. He does not regard it as a perfect appliance; and it is not quite adapted to its job. He asks, What does a fan do running at about 1000 revolutions? The answer is, "It projects the air in a cone." When it is far enough away, the effect becomes less intense; and the air is stirred more or less irregularly over a fairly large area. To anybody sitting near it, there is no choice between an intense breeze and stillness. He considers that to run a 12-in. fan in a small room is to overdo it, in concentration and intensity. He thinks there would be a market for a mechanical arrangement which would break-up the concentrated stream of air. He disputes the assertion of the traders who say "Electric-fans are a comfort," because they always give him a stiff neck. This is a good enough reason for his dissent.

Electric Fans.

Comment has often been made in the "Memoranda" upon the absurdity of continuing the percentage addition to pre-war prices of electricity, instead of consolidating price and percentage. There is disadvantage to the suppliers in not doing so; and the consolidation would anyway greatly simplify matters for electricity consumers. It is not at all likely that electricity undertakings will quickly drop to their pre-war price levels; and it seems to us that to maintain a complication is a decided hindrance—looking at the matter disinterestedly, and from a business point of view. "Meteor" in the "Electrical Times" refers to the same subject. He says the percentage increment was a simple and obvious thing. But it has its drawbacks; and this is becoming increasingly manifest now that reductions are being made everywhere. That is perfectly true. A reduction of the percentage does not appeal to consumers in the same way that a slice off the top of a flat-rate price does. Take the case of a pre-war flat rate of 4d. for lighting, which ascended to 4d. *plus* 100 p.ct. This is modest when we look down the list of electricity prices in the tables published by contemporaries. However, the 100 p.ct. has in cases decreased to 50, 60, or 70 p.ct. Take 50 p.ct., which would be 2d. off the pre-war price of 4d. *plus* 100 p.ct. "Meteor," asks: "Is the consumer satisfied with this?" The expression 4d. *plus* 50 p.ct., in his opinion, simply invites the consumer to be discontented, and to remain so. He still has his eyes on the 4d.; and he feels he has some moral right to it. Therefore he urges the abolition of the percentage figure; and the 4d. should now be 6d., or whatever is the proper figure. If this were done, then the 6d. or other consolidated figure would soon become the basic price in the consumer's eyes. We cannot say that we admire "Meteor's" ethics in this connection. He remarks: "It is highly desirable, as a matter of financial policy, that the flat rate for lighting should be as high as possible; partly to reduce the loss on the short-hour users, and partly to encourage the adoption of multi-part tariffs." In other words, he would have the long-hour users pay more to compensate for the short-hour ones. The heavier the consumption of the paying consumers, the more would they be fined for the deficiencies of the non-paying consumers. We do not like the idea, because it is not fair. The compulsory flat rate is nearing its end owing to a clause in the Electricity Supply Bill; but as a matter of practice, optional flat rates will take—"Meteor," says, an "unconscionable"—we will say a long time in dying. "They will persist in many places on the ground of simplicity, and from sheer force of custom. Being the refuge of the short-hour light user, they should be high enough to make him pay a greater share of the cost of supplying him than he does at present." Wherefore, our friend urges, no time should be lost in consolidating those percentages.

Pre-War Prices, Plus a Percentage.

Electrical engineers are now going to get into touch with the architectural profession. It is a remarkable thing that they have not done so long since. It is stated that it has been arranged to hold joint meetings for the purpose of discussing papers on the use of electricity for lighting and heating buildings, and for domestic purposes generally. Our electrical friends realize that the "influence of the architect is all-important in regard to the use of electricity for such purposes." "Meteor" of the "Electrical Times" says

Joint Meeting between Electricals and Architects.

that one of the causes militating against the more rapid spread of domestic electrification is that two of the persons most intimately concerned work for the most part in well-insulated compartments; and there seems to be reproach in his words that "somehow the gas engineer has established much closer relations with the architect." However, the "insulation" is going to be broken down; and so in the autumn a start is to be made by the holding of a joint meeting. Two papers, it is said, will be submitted—one from each side. The idea of a joint meeting originated with the electricals.

Powers of the Electricity Commissioners.

The difficulty between the Ealing Borough Council and the Electricity Commissioners has advanced a step farther than the statement in last week's "Memoranda" indicated. The matter refers to an agreement between the Ealing and the Hammersmith Borough Councils, whereby the latter has agreed to supply the former with electricity in bulk. The Electricity Commissioners have not sanctioned the scheme. Application was made to the Court for a rule *nisi* for a mandamus directed to the Commissioners requiring them to show cause why they should not hear and determine according to law the application by Ealing. It was submitted that the Commissioners were influenced by extraneous and irrelevant matters; and therefore their assent to the agreement which they could give under section 19 was not properly or judicially exercised. The Court said the rule could not be granted; but subsequently a similar application to the Court of Appeal was granted.

Fatal Shocks.

Certain of the electrical papers a short time ago were—although claiming to be technical journals—following the lead of the daily papers on the carbon monoxide question, and urging that the attempted inflammation of public opinion regarding carbon monoxide (which deservedly failed) was an opportunity which should not be missed for the development of business in domestic electricity supply. Week after week fatalities through electricity are seen; but no Prof. Bone or Dr. Haldane comes along to warn the public, and so the newspapers largely neglect to publish accounts of deaths from electrical causes. In the issue of the "Electrical Review" which has just been perused by us is seen the case of a boiler maker's assistant who received a fatal shock from a hand-lamp, due to a defect in a switch-box. The pressure was 220 volts alternating current—a voltage quite common in domestic supply. Then at the chemical works of Messrs. Cross & Co., Ltd., a workman met his death. He was in the habit of starting the electric-motor. On the day of his death, he went into the motor-house. A fellow workman heard him shout, and, on running to his assistance, found him lying on the ground unconscious with abrasions on the back of his head. Another workman said he saw the deceased's arm shoot up from the motor. He fell back; his head striking a door. The same witness stated that the previous day he received a shock while starting the motor. A doctor said the man's heart was not in good condition; and it was possible that he received a shock from the motor, which caused him to fall, and subsequent death. The jury found that the evidence was not sufficient to disclose the cause of death. But a man who is alive had a shock the day before! Perhaps it was a shock of less severity.

Complete Gasification Come to Stay.

That there is no doubt that the process of complete gasification of coal has come to stay, is the considered opinion of Mr. Edward L. Reiha, of Baltimore. He says that some of the results reported with the two most favoured processes in England would appear almost incredible. Yet the fact remains that both have been introduced very extensively, and are giving satisfaction. One of the late reports indicates that it is possible to obtain 54,000 c.ft. of gas of 396 B.Th.U. per cubic foot; the total inerts not exceeding 7 p.ct. The industry is here approaching the maximum thermal efficiency; for it means the recovery of about 70 p.ct. of the available B.Th.U. of the coal in the form of gas. Considerable argument has arisen over the quality of this gas, and similar gases of lower heating value, with particular reference to certain impurities (such as hydrocyanic acid) forming and reacting detrimentally in the storage and distribution systems. While admitting that for a time this did look like a formidable difficulty, he points out that, with proper study and experiment, the problem has been solved—alluding in this connection to the work of Mr. J. G. Taplay, and the Life of Gas-Meters Committee in England, and to the suggestion for providing a layer of calcium carbonate, or ordinary chalk, on the top grids of a scrubber. The same results no doubt, he says, can be secured by the liquid purification process, and using instead sodium carbonate solution for the absorbing medium. Gas plants should essentially be gas-generating stations; and personally he is "in accord with a certain English gas engineer who recently said that 'a therm in the gas is worth two in the residuals.'"

National Gas Council.—The fourth annual general meeting of the National Gas Council of Great Britain and Ireland is to be held in the Connaught Rooms, Great Queen Street, W.C., on Thursday, June 22, at 4 o'clock.

THE STRUCTURE OF COKE: ITS ORIGIN AND DEVELOPMENT.

By Sir GEORGE BEILBY, Director of the Fuel Research Board.

[**A Paper read before the London Section of the Society of Chemical Industry, May 29.**]

[Concluded from p. 560.]

Carbon in the form of coke is a very difficult material to examine microscopically. As already stated, it is a black glass, almost opaque, and entirely without metallic reflection. From its glasslike surface light under ordinary conditions is reflected without scattering. With lenses of low resolving power, the reflections from the surfaces of the more minute bubbles or cells give the effect of scattering; but on examination with the 16 mm. lens, it is seen that the surfaces of the minute bubbles or cells give the effect of scattering, but on examination with the 4 mm. lens it is seen that the surfaces of the minute bubbles are still glasslike.

As grinding and polishing lead to surface flow, these operations, if resorted to, must be applied to coke with great caution, as they may obscure or even completely destroy the real structure. For this reason freshly broken surfaces are much to be preferred, if they can be obtained reasonably flat. Broken edges often show details of structure which would have been missed on an unbroken surface.

METHOD OF EXAMINATION.

The general method of examination was as follows:

1.—The selected specimens were photographed at their natural size.

2.—They were then carefully examined in a good light with a hand lens; and the portion best suited for microscopic examination was broken off and trimmed for mounting. In every case a specimen having an untouched broken surface and edges was prepared; but in some instances additional specimens were prepared by filing and grinding on fine emery, great care being taken to remove the resulting dust from the structure. All specimens were examined in this way; so that the structure was traced continuously from natural size down to the limits of resolution by lenses of N.A. ·3 and ·95. These limits are in the region of one-thousandth and one forty-thousandth of a millimetre respectively.

3.—While photographs are of great value, they cannot take the place of patient and long-continued study at the microscope with gradually increasing magnification and resolution, and with varying illumination. In each case the lens was stopped-down till a clear picture with the necessary depth of focus was obtained.

4.—The specimens were photographed at magnifications of from 5 to 13 diameters, using planar lenses of 4·5 and 7·5 cm. focus.

5.—Many attempts were made to photograph the specimens, using the 16 mm. and 4 mm. apochromats with the vertical illuminator; but the range of focus of even the 16 mm. is so small, and the difficulty of satisfactorily illuminating a black glassy substance like coke is so great, that no satisfactory results could be obtained in the time at my disposal. I hope, however, to have greater success when time permits.

FUSING AND FROTHING STAGE.

These observations show that the coke structure, however minute, is due to the evolution of gas bubbles from the fused or partially fused coal substance. Probably the first step in this operation results in the formation of a foam in which each bubble is a self-contained cell; but by the mutual perforation of these bubble cells at their points of contact, a sponge is produced through which the gases ultimately escape to the outside of the mass. The special characteristic of fused coal substance which leads to the continuous development of this structure is that its decomposition with the evolution of gas continues as the temperature is raised. Gas which begins to come off at about 400° is still being evolved at 1000°, or even higher; and the walls of the bubbles which are generated at lower temperatures continue to give off gas and to generate more and more minute bubbles as the temperature rises.

Bubbles, however, can only be blown so long as the mass is sufficiently plastic. This places definite limits of time and temperature on the development of this structure, which ceases when decomposition has reached the stage when rigidity of the cell walls has set in. Though gas may continue to be evolved after this stage is reached, it can only escape from the surfaces which have already been developed and through the more intimate molecular structure of the vitreous substance.

The complex character of the decomposition of the fusible constituents of coal during carbonization makes it difficult to ascertain the limits of time and temperature at which rigidity sets in, especially as these vary considerably with different types of coal. We can, however, say with confidence that the carbon of which all forms of coke and charcoal are built-up is a fairly homogeneous, vitreous solid, in which the vitreous properties become more and more marked as the state of elemental purity is approached,

and, further, that the bubble structure which is developed during the fluid or plastic stage of carbonization, through the evolution of hydrocarbon gases, is finally stereotyped in this rigid vitreous material.

The experiments on the carbonization of sugar, which have already been referred to, throw a useful light on the subject; for in this case these limits have actually been defined. Rigidity sets in at 350°, and at 400° frothing and bubble blowing has ceased. No change in the minute structure occurs when the temperature is raised to 800° or higher. In the experiments with single minute crystals, the element of time was almost eliminated; for the crystals only weighed a few milligrammes. When the scale of the operation was raised in the assay apparatus by 100 times, the element of time obviously played a considerable part. The assay tube, which, under normal conditions, is sufficiently large for the carbonization of 20 grammes of coal, was completely filled by the frothing of the viscous material from 2·3 grammes of sugar; and the ultimate residue consisted of thin films of vitreous carbon.

Even in the small assay tube, it is evident that the penetration of heat through the frothing material was comparatively slow, and that it did not all reach the rigid state of carbonization at the same time. The time element, therefore, entered much more largely into the operation than it did in the case of the single crystal experiments.

In carbonization of coal on an industrial scale, in coke-ovens and gas-retorts, the influence of the time element is generally recognized, and has been carefully studied by many observers. I venture to hope, however, that the definite association which has now been traced between what occurs during the fusion and frothing stage in carbonization and the ultimate structure of the coke, may prove a new starting-point in these inquiries.

Dr. Lessing's Work.

Frothing with the formation of large bubbles only occurs when the froth is free to expand without the intervention of solid surfaces against which the bubbles burst, when the gas they contain can escape. This was demonstrated by Dr. R. Lessing in 1912,* in the laboratory assay apparatus which he had devised. In this apparatus, ground coal was carbonized in an externally heated silica tube placed vertically; the excessive foaming of fusible coals being completely controlled by allowing a loosely fitting plunger to press lightly on the surface of the molten coal. This caused the bubbles to burst, while the resulting gas escaped by the narrow annular passage between the plunger and the inner walls of the tube. Dr. Lessing's method includes the measurement of the volume of the resulting coke as compared with the original volume of the ground coal. Though this information is of value in the laboratory study of carbonization, it is not directly applicable to works practice. We gladly acknowledge the pioneering work of Dr. Lessing on this fundamental feature of carbonization, which goes far to explain the mechanism of the production of dense coke in modern coke-oven practice, where the finely divided coal is tightly packed in the ovens by the application of pressure.

In modern coke-oven practice the advantages of fine crushing and blending of the various bands of one seam or of several distinct seams are only partially recognized as the means by which homogeneity in composition and uniformity of any desired texture in the coke can be secured with certainty. We are hopeful that the detailed study of the subject which has been involved in the researches of the Fuel Research Board on carbonization will throw useful light on the structure of coke and on the methods by which this may be modified at will, so as to adapt this fuel more perfectly to the metallurgical and other purposes for which it is produced.

The Method of Blending.

Some two years ago we discovered that the excessive foaming of the more fusible coals could be completely arrested by a totally different method from that of outside restraint, which results from confining the coal in a restricted space during carbonization. This method we have generally referred to as blending. It consists in the intimate mixing of fusible with an infusible or less fusible coal. The proportions in which the selected coals should be mixed can be quickly determined by a few preliminary trials in the laboratory assay apparatus. When the proper mixture has been arrived at, little or no foaming occurs during carbonization, and the resulting coke occupies a smaller volume than the original coal.

By ensuring the shrinkage of the coke, one of the most serious of the difficulties in the carbonization of fusible coals is removed. For the past two years this method has been in regular use at the Fuel Research Station for the adjustment of fusibility, so as to ensure that the coke will contract and occupy a smaller volume than the original coal; and it has been fully described to many experts who have visited the station during that time. The idea has been taken-up by other workers, and is being practically applied in various directions.

Pulverized Coke or Breeze and Fusible Coal.

As a variation of the method referred to, pulverized coke or breeze has been successfully used as the infusible material in blends or mixtures. The most obvious disadvantage in the use of coke for this purpose is that, while it contributes no gas and no oil to the output of the operation, it occupies space in the carbonizing apparatus, and involves costs for handling and fuel which could be more profitably expended on the carbonization of coal of low fusibility and high volatile content.

Our Chairman Mr. E. V. Evans has, however, shown that an admirable smokeless domestic fuel can be produced by carbonization of a blend of gas-retort breeze with a fusible coal. This very promising departure was referred to at the meeting of the London Section on April 3 last. It is a remarkably homogeneous material, in which the bubble sponge structure is uniformly developed, and on just the right scale for a fuel which is to be used for domestic purposes.

My own interest in the micro-structure of coke was greatly stimulated by the remarkable work of Messrs. Sutcliffe and Evans on the briquetting of pulverized coal as a preliminary to carbonization. This at once appealed to me as the logical sequence of our own work on the blending of coal crushed to a moderate degree of fineness. It has been proved by these pioneers that the control of bubbling and frothing by grinding and blending, which made it possible to develop the reactive surface within the mass without too great a sacrifice of density and robustness, could be almost indefinitely extended by the briquetting of finely-ground coal by pressure as a preliminary to carbonization. It has therefore been a work of great interest to trace the absolute continuity of the bubble sponge structure from its most obvious appearance in the carbonization of a highly fusible coal through all its intermediate stages to the remarkable absorbent carbon which was produced by Sutcliffe and Evans to replace the most absorbent forms of wood and nut charcoal for the gas masks supplied to our soldiers at the front.

It is stated that this material has at least three times the gas-absorbing capacity of the best wood charcoal. My belief is that the absorbing capacity is mainly, if not entirely, a question of surface, and that the conversion of vitreous carbon into thin films by the blowing of bubbles is the most effective known means for the development of enormous internal surfaces.

It is evident that Thorner's conclusion that the relatively large pores or cells which were disclosed by his method of examination were bounded by walls consisting of "an extremely close, impermeable, glassy mass" cannot be supported. We have seen, on the contrary, that this glassy mass is possessed of a sponge-cell structure which, under suitable conditions, may have a minute porosity which is not only comparable with that of wood charcoal, but may far exceed it.

Porosity.

The structure of coke has been considered by metallurgists from three points of view. These are porosity, density, and reactivity. Reactivity appears to be generally regarded as depending on chemical rather than structural changes in the carbon. Porosity and density are treated as purely reciprocal; the ratio of the relative volumes occupied by the actual coke substance and by "pores" in any given specimen being calculated from the apparent and the real specific gravities. It is obvious that this method of estimating porosity gives no indication whatever of the relative area of the internal surfaces which have been thereby developed, for this involves a knowledge of:

(1) The size of the pores.
(2) Their number and distribution in the mass.
(3) The thickness of their dividing walls.

Consider the case of a coke in which the ratio is as 1:1; the specific gravity of the carbon substance being 1·9, and of the coke ·9. One cubic inch of coke will contain half a cubic inch of carbon substance and half a cubic inch of air space. Assume that the whole of the carbon is concentrated in the lower half of the cubic inch, and that this can be sliced horizontally into sections 1-1000th of an inch in thickness, and that 500 slices so obtained are extended upwards at intervals of 1-1000th of an inch, so that they occupy the whole of the cubic inch. We should then have a block of coke the specific gravity of which would still be ·9, and its reactive surface would be about 1004 sq. in., as compared with a reactive surface of 4 sq. in. in the solid block of carbon substance. It is obvious that, by making the slices of carbon substance and the spaces between them 1-100th of an inch in thickness and width, the specific gravity of the block would still be ·9, but its reactive surface would now be 204 sq. in., instead of 1004 sq. in. By reducing the spaces between the slices of 1-1000th of an inch to one-half the thickness, the specific gravity of the block would be raised to 1·2, and the reactive surface to 2667 sq. in.

So far, therefore, as reactive surface is concerned, the ideal condition would be the sub-division of the whole of the carbon mass into films of minimum thickness separated by spaces of equal width. This ideal can most nearly be approached by the bubbling method, by pulverizing and pre-briquetting suitable blends of coal, so that the sponge cells are small and their walls as thin as possible. The apparent density of coke obtained in this way may reach 1·33 sp. gr. The air space must therefore be of the order of one-fourth of the volume.

Let us turn now to the other aspect of porosity—its influence on the accessibility of the reactive surfaces within the mass to oxidizing gases. The users of metallurgical coke have in the past attached great importance to this function of porosity, in the belief that full advantage of the reactivity of the internal surfaces can only be secured by free access of the oxidizing gases and the

* "A Laboratory Method for Comparing the Coking Properties of Coal," by R. Lessing, Ph.D., F.C.S.; a paper read before the Institution of Gas Engineers, June 13, 1912.

equally free removal of the products of oxidation. If it may be assumed that a sample illustrated in the paper may be taken as a metallurgical coke which meets this condition, it is of interest to determine the size of the larger bubble units. These range from 3 to 4 mm. down to about 0·5 mm. in diameter. We may take it, therefore, that free circulation of gases will mainly occur through the larger of these, as they have probably been opened-up and kept open by the rapid discharge through them of the carbonization gases. They have formed ducts through which the gases from the areas of the more minute bubbles have escaped.

In the much denser pre-briquetted coke, the larger pores range from 0·5 mm. to 1 mm.; and it is evident that in this case also these have been the main ducts for the escape of gases. But the fact that the combustion of these briquettes proceeds definitely from the outer services inwards, shows that the internal circulation of the oxidizing gases is much more restricted than in the case of metallurgical coke. Sutcliffe and Evans believe that the reactive surface of the coke briquette is so immensely greater than that of metallurgical coke that the increased rate of combustion more than compensates for the less free circulation throughout the mass.

This question of the relation of "accessibility" of surfaces to rate of combustion is now being investigated by Mr. E. C. Evans and Dr. Wheeler.

DISCUSSION.

Mr. E. V. EVANS (Chairman of the London Section), who presided, stated that the lecture had been intended to be given at the Smoke Abatement Exhibition, where the Society of Chemical Industry had arranged some discussions; but this had had to be postponed. It was exceedingly fortunate, however, that Sir George Beilby had been good enough to agree to give the lecture at the last meeting of the session of the Section. He (the speaker) had not been able to go over the paper beforehand; and personally he was overwhelmed with what he had heard. Though he was supposed to know something about coke formation, he very much wanted to be able to settle down and think about the paper afterwards, rather than talk about it now; but Sir George Beilby wished him to say something about the material that his Company had been working upon. Admirable though ordinary coke was—particularly in these days of servant difficulties—it was not the sort of thing one wished to have one's household fire charged with; and his Company came to the conclusion, after taking advantage of the work of Sir George Beilby, Mr. E. C. Evans, and others upon the subject, that if they could admix the ground coke with some fusible coal, or coal which under disullation conditions would give a compact mass, they had ample waste heat for the purpose in their retort-settings. The experiments were exceedingly successful, because they had stumbled against the fact which Messrs. Evans and Sutcliffe demonstrated a few months ago—that this finely-ground material combusts in an exceedingly active way. His Company did manufacture an excellent fuel. The general financial conditions of its manufacture were good; but there was one big difficulty—that the coal which gasified and coked well usually had a high ash content, and it became an expensive matter to put down the necessary washing plant for this. He believed they would be able to do it; but at the present moment this fuel, which was ground and which combusted so readily, did not look quite as nice as it should, though the ash was a better one, and did not float about the room like the ordinary ash. They had therefore come to the conclusion that they must get the washing plant into operation before the fuel could finally be put upon the market. This was the position. He would very much like to have a short discussion on the paper, though he did not suppose that it would do more than take the form of asking questions. There were present a number of experts on the subject of the carbonization of coal.

Dr. R. LESSING said that Sir George Beilby had been good enough to make reference to a paper which he himself had read* before this Section of the Society some ten years ago. He was afraid that modest contribution to the subject made a very small impression, as compared with the fundamental paper they had just listened to. This work of Sir George Beilby's opened-up an entirely new vista; and no doubt many of them who had been dabbling in the complex problem of carbonization would turn their minds in the direction indicated by Sir George Beilby. Not only was the paper of a fundamental character, but it also demonstrated the extremely high manipulative skill which Sir George had brought to bear on the subject—for which many of them envied him, because they simply could not follow on these lines. Referring to one small point arising out of the paper which he himself had read ten years ago, he was extremely gratified to find in the contribution by Sir George confirmation of an explanation of a phenomenon which at the time he only gave tentatively. On that occasion he had shown some coke specimens from one particular coal which in every instance turned out with a certain iridescence on the surface. The specimens of carbonized sugar which Sir George had exhibited gave the explanation of the peculiar phenomenon referred to. During the discussion on his own paper, he was asked by one gentleman whether it was due to the presence of aniline dyes in the coke or coal [laughter]; but they now knew that it was akin to the colouring of soap bubbles, simply due to the extreme thinness of this coke foam. There was one point bearing on the subject of coal carbonization which had not been attended to sufficiently, and the paper that evening would probably lead the way to a better consideration of it. Sir George had told them that the carbonization of minute particles of coal could be considered as comparatively uniform reactions. On the other hand, if they took even small quantities, such as 20 grammes, in the assay apparatus—or even 1 gramme, according to his observations—uniform reactions did not any longer go on. The walls and centre of the material showed entirely different structures. Again, if they took a coke-oven charge of (say) 10 tons at a temperature of 1200° C. at the walls, it would be found that the outside skin of that coal only became carbonized where it was in contact with the oven wall. There they had high-temperature carbonization *par excellence;* but it must be remembered that the crude gas and tar vapours of a pitchy nature found their way towards the centre of the charge (the same applied to the gas-retort), and eventually gave an inner core which showed what Sir George Beilby had called the bubble structure of coke. This was, in effect, the condensation of the primary products of carbonization from another part of the oven, producing in the centre a mixture of coal and these primary products which was in no way similar to the original coal. This was a point which fitted in very well with the theory that had been propounded by Sir George Beilby, and also demonstrated the extreme difficulty of dealing with carbonization problems, inasmuch as they never had a chance to consider the problem from this point of view of the original raw material, but had to deal with one which was progressively altered throughout the whole coking process.

Mr. E. C. EVANS said he would like to add his appreciation (and that of his colleague) of the brilliant lecture they had heard. The importance of the work was that Sir George Beilby had resolved for the first time, not so much the cells in the various cokes, as the walls of the cells. The structure of these walls was of importance, and played a tremendous part, not only in carbonization, but in chemical reactions of quite another order. He believed this question of structure was going to be of vital importance in the future, not only in connection with coal carbonization, but in practically all chemical reactions in which solids played a part; and if we could only get the initial structure which would allow these chemical reactions to take place more freely and more easily, he believed we should be able to solve commercially a number of the problems facing industry to-day.

A hearty vote of thanks was accorded to Sir George Beilby, on the motion of Sir FREDERICK NATHAN.

* See "JOURNAL," May 14, 1912, p. 437.

ILLUMINATING ENGINEERING SOCIETY.

Annual Report.

The report of the Council of this Society on the work of the past session shows that much of a useful nature has been done—one feature being the co-operation of the Society with kindred bodies on subjects of common interest. There were congratulations to the President (Sir John H. Parsons, C.B.E., F.R.S.) on his knighthood, and pleasure at being able to announce his consent to continue in office. The report reviewed the proceedings at the meetings, and then referred to a joint discussion with the Royal Institute of British Architects. It is hoped that there will be other opportunities for fruitful co-operation with the architectural profession in the future. The review of the proceedings shows that the programme for the session has been of a varied and interesting character.

The arrangement by which the Presidents of kindred bodies become members of the Council during their tenure of office now applies to the following bodies, whose co-operation continues to be of service in dealing with problems of mutual interest: The Illuminating Engineering Society in the United States, the Illuminating Engineering Society in Japan, the Institution of Gas Engineers, the Institution of Electrical Engineers, the Council of British Ophthalmologists, the Ophthalmological Society, the Physiological Society, the Electrical Contractors' Association, the Society of British Gas Industries, and the Association of Railway Electrical and Telegraph Engineers.

The arrangement whereby two classes of members (members and associates) are recognized has operated satisfactorily, and has led to a material increase in the revenue of the Society, which, however, is not sufficient to permit the proper expansion of work of which the Society is capable. While the Society can doubtless continue on its present lines, it has become evident that, if it is to extend its operations in a manner commensurate with the importance of its aims and objects, a considerably higher revenue must be obtained—either by increase of membership or in the form of contributions from bodies that benefit by the work on which the Society is engaged. Another matter that is now receiving the attention of the Council is the case of members whose subscriptions are considerably in arrears. In many cases this is due to members having lost touch with the Society during the war period; and it is suggested that in such cases some method of compounding for the arrears may be adopted.

World's Petroleum Output.

The American Petroleum Institute estimate the world's petroleum production in 1921 at 759,030,000 barrels, as compared with 694,854,000 barrels in the preceding year. The increase for 1921 indicated by these figures is 9·2 p.ct. The marketed production of the United States last year, as reported by the Geological Survey, was 469,639,000 barrels, which compares with 443,402,000 barrels in 1920. The total United States production in 1921 was 61·9 p.ct. of the estimated world production. Mexico's production last year (which was 25·7 p.ct. of the world's production) totalled 195,064,000 barrels, as against 163,540,000 barrels in 1920—showing an increase of 19·3 p.ct.

A mixture consisting of 900 parts of benzine, 100 parts of 95 p.ct. alcohol, 17½ parts of hexanol, and 37½ parts of phenol is recommended by Prof. Godchot, of Montpelier. Experiments with this fuel have recently been made at Beziers, where its superiority over a number of other petrol substitutes is said to have been demonstrated.

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

Meeting at Cardiff.

A thoroughly successful meeting of the Institution was held last Thursday, when the members were the guests for the day of the Cardiff Gas Light and Coke Company, who did everything imaginable to ensure an enjoyable time for the visitors. On various previous occasions the Institution have been to Cardiff; and, if it be possible, their welcome seems to become even more cordial as time goes on. This is proof of appreciation of the good work the Institution are doing. During the day, Mr. Charles E. Dovey, J.P. (the Chairman of the Company), Mr. George Clarry (the General Manager and Secretary), and Mr. H. D. Madden (the Engineer) fulfilled admirably the duties of hosts. The meeting was good also in point of numbers—about fifty members attending, under the presidency of Mr. JAMES ROBB, of Chepstow, who delivered his address.

The meeting was held in the Park Hotel, Cardiff; and on being called to order by the President (Mr. James Robb, of Chepstow), the HON. SECRETARY (Mr. Octavius Thomas, of Pentre) read the minutes of the last meeting, which were confirmed.

NEW MEMBERS.

On the proposition of Mr. G. MAYNE (Penrhiwceiber), seconded by Mr. F. HILL (Usk), the following new members were elected: Mr. Hubert Edward Jenkins, Manager of the Lydney Gas Company; Mr. Arthur George Lofthouse, Manager and Secretary of the Tawe Valley Gas Company, Pontardawe; and Mr. Colin Boyd Felton, Assistant at the Newport (Mon.) Gas-Works.

ANNUAL REPORT AND ACCOUNTS.

The HON. SECRETARY then submitted the report and accounts.

The Council, in presenting their seventeenth annual report, expressed regret at the death of Mr. T. H. Hazell, of Newport (Mon.), the only honorary member, who had taken an active part in the work of the Institution. During the year four members had joined the Institution, two resigned, and the honorary member had died, leaving the number at the end of the year at 77 members and 5 students. The receipts for the year amounted to £33 11s., and the payments to £24 16s. 3d.—leaving, with the balance brought forward from last year, the sum of £65 11s. 5d. in the hands of the Treasurer.

The report and accounts were adopted, on the motion of Mr. W. H. JOHNS (Swansea), seconded by Mr. J. STEPHENSON (Ferndale).

NEW OFFICE BEARERS.

On the recommendation of the Council, the following officers were elected for the ensuing year:

President.—Mr. Octavius Thomas.
Vice-President.—Mr. W. C. Jackson.
New Members of Council.—Messrs. H. D. Madden and F. Hill.
Treasurer.—Mr. Henry Morley.
Secretary.—Mr. Octavius Thomas.
Auditors.—Messrs. J. P. Jones and A. T. Kyle.

THE NEW PRESIDENT.

The PRESIDENT said it was his privilege to propose a gentleman for the Presidential Chair this year whom they all delighted to honour. He was practically the founder of the Institution, and had been untiring in his efforts to make it a success. Looking upon the attendance that day, they must admit that these efforts had succeeded. He was always at the disposal of every one of them. The gentleman to whom he referred was Mr. Octavius Thomas.

Mr. J. H. CANNING (Newport) said it was a great pleasure to second the motion, which really needed no recommendation to the meeting. It had been felt by the Council that they could do no less, after the immense amount of work that Mr. Thomas had devoted to their interests, than to offer him the highest honour that it was in their power to bestow.

Mr. R. A. BROWNING (Bristol), in supporting the proposition, recalled the fact that at the time of the formation of the Institution he himself was under the impression that it was not going to be a success; but he was pleased to admit now that he was mistaken in this view. With the late Mr. Thomas Canning as their first President, things went on flourishingly. He (the speaker) happened to follow Mr. Canning in the chair. Certainly, they owed a very great debt of gratitude to Mr. Thomas for his unceasing work on their behalf. He had treated all alike, and given fair play right through. [Applause.]

Mr. JOHNS, proposing as Vice-President Mr. W. C. Jackson, of Neath, said that he had been for some time past an active member of the Council; and they looked forward to hearing in due course an account of the work he had been undertaking latterly at Neath, which would no doubt prove of great interest to them.

Mr. A. J. BOND (Aberavon) seconded Mr. Jackson's election.

Mr. W. C. JACKSON (Neath) proposed as the two new members of the Council Mr. H. D. Madden and Mr. F. Hill, and pointed out that both were well-known members of the Institution. Mr. Madden had already been on the Council.

This was seconded by Mr. J. E. KENSHOLE (Merthyr Tydfil).

The PRESIDENT, in proposing that Mr. Thomas should combine the office of Secretary with that of President, said that, of course, it would entail some extra labour on his part. But it was always the willing horse that got the work; and Mr. Thomas possessed all the qualifications to enable him to bear the strain.

Mr. BROWNING seconded the motion.

BENEVOLENT FUND OF THE INSTITUTION OF GAS ENGINEERS.

The HON. SECRETARY proposed that the sum of five guineas should be subscribed to the Benevolent Fund of the Institution of Gas Engineers, and at the same time impressed upon the members the necessity of giving individual subscriptions in addition. He said that while he was acting on the Committee of Management there had been some very sad cases brought to his notice. If only members would subscribe more freely, greater good could be accomplished by the fund than was possible now. It was stated in the report which would be submitted at the forthcoming meeting that only 40 p.ct. of the members were subscribers. In their own district, the proportion of subscribers was only about 20 p.ct., so that there was plenty of room for improvement.

Mr. J. P. JONES (Caerphilly) seconded the motion, which was agreed to.

Mr. ROBB then proceeded to deliver the following

PRESIDENTIAL ADDRESS.

Gentlemen,—I beg to thank you for the honour you have conferred upon me by electing me to the presidential chair—an honour I very much appreciate, seeing I am one of the "small fry" of the Institution. But one thing—it shows the broad-mindedness of our Institution and recognition of the fact that all sorts and conditions of men are required in conducting the affairs of the world; all are useful in their own sphere. Another important point is that it gives a small man an opportunity of mentioning small matters that cross his path, which could not be dealt with in a paper, as, from his circumscribed conditions, he is at a great disadvantage compared with the engineers of large undertakings who, as a rule, have the necessary assistance, appliances, and time to experiment and investigate the why and wherefore of difficulties encountered from time to time. To-day I do not mean to speak to you on a small matter, but on a very big matter—Does the gas industry receive the recognition and respect which, from its great importance, are its due?

Let us go back to the Peace of Amiens, which, in my opinion, is the most important period in the history of the British Empire. At this period the nation began to emerge from a "nation of agriculturists and shopkeepers" to a "nation of manufacturers." Invention after invention of machinery took place, closely following Watt's discovery of the power of steam, which was the means of raising the standard of comfort of the inhabitants of this country and practically made us the workshop of the world. But what at that time was a great drawback to our progress was the want of artificial light. There was no petrol or petroleum in those days; the only means of lighting being by candles and sperm oil.

At this period Murdoch had discovered a method of producing artificial light without the necessity of using a wick, and which at that time had never been equalled for brilliancy or adaptability—coal gas. This enabled the country to make industrial progress and achieve the supremacy it has now reached, but which it is now likely to lose, unless a very drastic change comes over the mentality of employers and employees alike, and we cease sending so many of the "briefless barrister and paid agitator order" to Parliament, whose policy seems to me to be self-glorification or attaining some selfish end, no matter what the result may be to the country in the end. Personally, I do not believe that more than 10 p.ct. go into Parliament with the genuine intention of doing their best in the interest of the nation as a whole. One of the latter class, who will not be led away from the straight path of equity, represents this city, and until more like him are sent to Parliament, I fear the country is doomed.

Now let us pause and think. What has the discovery of gas lighting done for this country? Besides greatly assisting us to become the manufacturing and commercial centre of the world, it has revolutionized the street lighting of our towns. Prior to that they were a danger to the inhabitants. They were infested with bands of thieves, who took advantage of the darkness to commit all sorts of crime, murder being often committed with impunity. But with the advent of gas lighting these scenes of bloodshed and robbery all but disappeared, and the populace were able to parade the streets after daylight and do business in safety and comfort. To the shopkeeping community gas lighting came as a boon and a blessing. The artizan can light his home at a cost within his means, as well as the peer within his palace; he is placed in a position, if he is so minded, to study and acquire knowledge and improve himself, or to pursue some favourite hobby in the way of making various nick-nacks at home. Gas

has also enabled newspapers to be printed and published early in the morning, and later, with the aid of gas power, to produce cheaply, and so increase the newspaper business.

How often do we hear the remark "Do a man a kindness, and he will repay you with kicks!" The least little mishap with gas, no matter how trifling, is laboured and magnified, one might almost say, into a national catastrophe by the daily Press. How differently they treat the electrical industry—no matter how many (and they are very numerous) fused wires start fires; and they are generally of a most disastrous character, and very difficult to put under, as any fire brigade can testify. If mention is made of them, it is only a mere record and no more; no editorial leader appearing as to the great dangers arising from electric-started fires, to say nothing of shocks and deaths from contact.

Now, how do we stand with Government Departments? It is common knowledge that in 1915 the gas industry practically saved this country. When matters were explained to us, all went to work with a will, and never for a moment considered the question of fee or reward; the only aim and desire being to save our country from conquest. How were we treated? We were compelled to sell our bye-products to specified firms, who immediately depreciated their value below starvation point, while the distillers made huge profits. An appeal was made to the Government on the matter, and what was the result? They could not interfere; and we must make the best bargain we could with the distillers. At this time the Government were praying to the inhabitants of the country for God's sake to use gas for all purposes for which it could be used, to the exclusion of all other methods.

Now I will relate to you what at this time was done in Chepstow by the Government—which is only a recital of what took place all over the country. As I told you about two years ago, the national shipyards were started by a company of highly competent engineers; but Sir Eric Geddes, on behalf of the Government, thought fit to commandeer the works, of which they have made an unredeemable muddle. It is high time some one took up the matter with a view to getting a committee of inquiry appointed to investigate the whole affair from beginning to end, and more especially the financial side, as in my opinion the amount of money that has been squandered in Chepstow has never been brought to public view.

The time the Government took charge was the very time they were pressing the country to use gas. Well, what do you think they did in Chepstow? They took over every building, with one exception. They immediately commenced to pull out the gas-fittings and replace them by electricity, installing electricity all over the district wherever they could possibly get it in.

I would like to diverge from my subject for a few sentences to give you one reason—and a very important reason—for this being done. In my intercourse with them I found a good proportion of the so-called Royal Engineers (pardon the title) had been trained as electricians. Their parents had spent goodly sums on their training, and when their articles were finished they were so numerous that there were no situations for them, and the war had in reality turned out a godsend to them. Now here, again, the Government blundered. Instead of keeping them at home, they should have sent them to the front. They then commenced the erection of a so-called super-electricity station, the cost of which no one knows, and at present all the revenue they derive from the sale of current does not pay the twelfth part of the wages. Mark that this waste is still going on, and there are no signs of its stopping.

When H.M. Office of Works took over the work they investigated the merits of gas and electricity, and gas came out triumphantly, which it always does when it has a fair field and no favour. We were asked to quote our terms for rearranging and extending our plant and works to supply Pennsylvania and Bulwark villages to meet the extra demand that would result therefrom. This we did. But seeing how things were managed, I specified that all the work would have to be executed under my direct supervision and entire control. This, I fear, settled the matter; for they commenced at once, at an enormous cost, to lay cables to Bulwark and Beachley, and for which the electricity company has not yet been asked to pay one penny, although they have been deriving revenue therefrom. In Bulwark, at the present time, the tenants are one by one discontinuing the use of electricity and clamouring once more for a supply of gas. The Gas Company have suffered seriously financially from the Government's action, and the Government refuses to meet us in the matter of relief. In fact, they have screwed all they could out of us, although they knew we were doing the work at a discount.

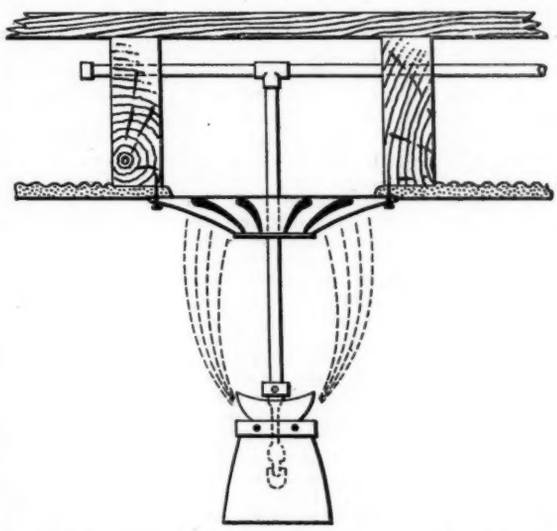
The Office of Works is a department the Government would do well to abolish, which would result in a considerable saving to the Exchequer. Now here we are—the Government propagating the coal-exhausting electrical industry at the expense of the entire nation, which will result, in a very short time, in being the country's ruin; and in our case refusing to give us a single penny to get us out of the difficult corner in which we have been placed through their action, and through subsidized money putting the Electricity Company in an unfair position to compete with us. The country has already given twenty millions to the Electricity Commissioners; and what is there to show for it?—Nothing. The money might as well have been thrown into the sea.

GAS APPLIANCES.

Now let us have a glance at the gas appliance manufacturers. They, too, have caught the fever, which is one of the reasons why they are charging such outrageous prices for all appliances and plant. And the insulting circulars and illustrations some of them send out, mentioning electric and steam-driven appliances, but never a word of the cheapest of all powers—viz., gas power! This is one of the matters in which the gas-engine makers have let us down tremendously. They have been devoting their attention almost exclusively to large engines, and grossly neglecting the handy small engine. If they would give more attention to small engines and try to get them self-starting, it would be more profitable to them in the end than assisting the electricity industry to compete with us by producing large-power engines to compete with steam turbines.

At this point I would like to sound a note of warning on the question of the education of the gas engineer of the future. All plant that the manufacturers are turning out is not coming up to the standard claimed for it, and in many instances all sorts of alterations have to be undertaken even to get it to work anything approaching the merits claimed for it. There is a reason for this. It is that the manufacturers do not often enough come in contact with us and talk matters over. They have no knowledge of the practical side of gas production. There is too much theory and too little practice; and some draughtsmen are so conceited that if one gives them a hint as to where they are wrong, they treat it with scorn, and it goes in at one ear and out at the other. They only construct from the plans of some gas engineer, and put plant on the market irrespective of varying conditions existing in one works and another. In our industry we are mostly mechanics; and all the improvements that have been made in gas manufacture and plant have emanated from within our own ranks. This position we must make a strong effort to maintain, or otherwise the industry will work out its own ruin, with too much theory and too little practice. We must all draw closer to the chemist, and the chemist to us.

Let us look at the case of gas-fitting and domestic gas-consuming appliance manufacturers. They advertise the virtues of their wares in our technical papers. This is good as far as it goes. But why not advertise them occasionally in the daily Press, and so bring them before the notice of the general public, who will get interested in them, and inquire at gas showrooms for further information regarding them. When speaking of gas-fittings, I would like to draw your attention to what would be a very great improvement in gas lighting—an ornamental ventilator in the centre of the room, with, if possible, a centre light as shown on the sketch—wall lights being very inefficient. This would result



in one of the greatest blessings that has ever taken place being conferred on the consumer. It would ventilate the room and cause that slow continuous motion in the air that is so essential to health, and which no other artificial light can accomplish. Objections may be made that the carbon dioxide would rise to the rooms above, unless a flue was provided to conduct it into the chimney. Such is not the case. As you know, wood absorbs carbon dioxide with avidity. CO_2 prevents dry rot and worm-eating. It also hardens and improves the plaster on the roof; and this also will absorb more CO_2, many thousand times more than could ever possibly be produced from gas lighting.

There is another side-show matter to which I desire to draw your attention—that crude ammoniacal liquor is the best agent for preserving timber and making it absolutely non-inflammable. Simply allow the timber to float on the liquor, and it absorbs all it requires. I have done this with success for twenty years with wood used for damp outside positions and where exposed to heat. In addition, it does not discolour the wood. If this is pushed, it might create such a demand as would absorb a very large proportion of liquor, and so enhance its ultimate value.

PUBLICITY AND PROPAGANDA WORK.

I have now arrived at a stage at which I should like to dwell for a little time regarding the publicity and propaganda work of

the British Commercial Gas Association. They started well and did good work, because their methods were suitable to that time. But things have changed; and in my opinion, although the B.C.G.A. are progressive, they have not changed in the right direction. They have not given sufficient attention and push to lighting—the most important part of our business; also the most stable part. We must fight to the death to retain it, and regain lost ground. The B.C.G.A. have been very successful with the medical profession, and a great change has come over their attitude towards gas. Let them keep up the drive here with might and main. Their success in this direction has encouraged them to make an attack upon the architects; hence these expensive conferences they have inaugurated, which up to now have not done one atom of good. If they imagine they are going to capture the architects, they are on a wild goose chase, at the present time at least. Architects may give attention to gas later on.

A lady I knew fitted up her house with electric light, and a few years after decided to build a new house. She decided it would be an all gas house. A London architect was engaged and instructed accordingly. He, however, specified for electric lighting, but all other appliances were specified for gas. It was not discovered that electric light had been specified for until the construction was well advanced. When the architect was questioned regarding the matter, his reply was that all modern houses were built with low roofs, and the only light that could be used in them was either electric or oil lamps. Mark this. An architect outraging the essential principles of hygiene. The owner's answer was this: "You had no right to design the house in such a way, as you were told quite distinctly it was to be lighted by gas; and by gas it shall be lighted. We were induced to instal electric light in our last house by a lot of plausible tales of its cheapness, convenience, and cleanliness; but we have found out the hollowness of the so-called advantages, and as to price, it is not in it with gas. Besides, one cannot see to do anything with it unless it is stuck close to one's nose, and our eyesight has suffered from it." Well, after a big struggle, the architect agreed to gas being installed.

The B.C.G.A. should consider the desirability of dispensing with these expensive conferences and these whole-page £300 to £800 advertisements, and confine themselves to short paragraph advertisements in the daily Press, and not in any one newspaper, but in all newspapers over the entire country, and not give so much attention to the so-called society papers that are only seen by a few and only looked at to see the latest fashion in hats and gowns. Extol gas lighting from a health and economy point of view. Scotsmen say you can conquer an Englishman by cutting short his beef and beer. Irishmen say you can knock an Englishman down by emptying his pockets. Both sayings to a very great extent are true. So take the hint that nothing can cook a dinner like gas, and at such a low cost that it really puts money in the pocket.

Gas v. Electricity.

Now let us consider the sum total of the whole matter. Incandescent gas light is the finest, most diffusive, effective, healthy, and cheapest artificial light for general use in existence. Gas for cooking is the most adaptable and economical method known. For intermittent heating it leaves all other systems hopelessly behind; and for continuous heating is not very far behind coal and coke. For office and shop heating it is the system *par excellence*. For power from ½ to 50 H.P., no other method or system can approach it for cheapness.

Let us have a look-in at our competitors. Electric lighting is destructive to the eyesight, nerves, and hair, and, if persisted in, will convert us into a nation of Chinese, besides exhausting our coal supplies within a very short period. It is also, on the average, three times more costly than gas, light for light, and conditions being equal. As for heating, it is only convected heat, therefore unstable; and the price paid for electric heat gives the consumer an electric shock at the first glance at the bill, notwithstanding that it is sold at a price below the cost of production. For power, certain claims are made on its behalf as to its convenience, which are magnified fourfold. Although sold at about one-third of the cost of production, it is more than double the cost of town gas, even when gas is charged at a price approaching the lighting rate.

You may say we know all this, but what about the remedy? Well, I will try to suggest one. Let us have a look-in at our competitors once more. Everyone connected with electricity holds a brief for it, from the top-dog down to the message boy—including directors, shareholders, and workmen's wives. Every one of these is an active canvasser, and filled to the brim with the fanciful, preposterous, unattainable virtues of electricity. But when tackled, how quickly they clear out, because they have only stock arguments which are supplied to them from headquarters.

Now, my remedy for counteracting this is: Let us have one principal main organization, such as the National Gas Council, which is doing splendid work; only let it be composed of every section of our industry—directors, engineers, managers, accountants, superintendents, commercial managers, chemists, manufacturers, and juniors. But as the engineers are the root, they must be in the majority on the executive. Let us have one big annual meeting, to receive their reports and hear the President's address. Then all the various sections can retire to separate compartments, each to deal with its own particular branch, as at present. All moneys should go to the principal organization, and each section voted a fixed sum to cover its expenses for the ensuing year.

We have got all the component parts; they only require welding together. With such a solid organization, we could make our voice heard and our influence felt; and it would enable us to cope successfully with the exaggerated and preposterous electric-inspired propaganda that takes place from time to time.

Everyone in such an organization would be a real member, and hold a brief for the gas industry. I have refrained from going into the details of the construction of the organization, as it would be presumption on my part to do so. Now the subject is open to debate; and to the best of my ability I will try to answer all questions.

Remarks on the Address.

Mr. H. D. Madden (Cardiff), proposing a very hearty vote of thanks to the President for his address, remarked that Mr. Robb had adopted the unusual course of inviting discussion upon it, and therefore he would say a few words. They all knew Mr. Robb very well, and were aware that he received part of his life's education in Scotland and part in Ireland. He thought they could see this fact coming out in the address. While listening to the address, the thought had occurred to him, Where would the country be without its gas-works? Let them reflect for one moment upon how much the country depended on gas. The fact was certainly not sufficiently understood by the public generally. Where would the nation have been in the last war, had not gas undertakings been able to provide the materials required for high explosives? Where would it be in another war, if the gas-works were not maintained and properly looked after? Think also of all the other things the industry provided from coal. Further, it was only dimly appreciated generally that the coal supplies of the country were getting short. Of the total heat of coal, gas-works could put 75 p.ct. to the service of mankind; while in the case of the electric super-station the proportion was barely 20 p.ct. On which side was the conservation of fuel here? Again, the bye-products were saved on the one hand, and on the other they were sent up the station chimney. Mr. Robb had drawn attention to many points; but it seemed to him that he had made hardly sufficient of the ventilating effect of gas lighting. Only a week or two ago, he (Mr. Madden) was in conversation with a party of electrical engineers—not lighting engineers—and he was very much struck with a remark made by one of them: "The gas industry has the fuel that can pour the greatest number of heat units on a given spot in the shortest possible time. I wonder they do not make more of that fact."

Mr. Canning, seconding the vote, said he thought they were much indebted to Mr. Robb for giving them such a vigorous and spirited address. Perhaps they had rather been inclined to take things too quietly; and it was therefore just as well now and then to have points like this brought before them. He must differ with him on one matter. Mr. Robb called himself one of the "small fry" of the Institution. True, he happened to be connected with a comparatively small undertaking; but he (Mr. Canning) regarded him as rather one of the "bigger guns" of the industry. One matter omitted from the address, and to which he would like to make brief reference, was the work Mr. Robb himself had done during the war. He did give a short synopsis of the struggle that he had had in the interests of the industry with various Government Departments; but some of them had had the pleasure of sitting on various Committees with Mr. Robb at that time, and he had encouraged them all very much by his cheerful optimism during this dark and difficult period. In fighting for the interests of the industry, he was constantly visiting London and interviewing the heads of Government Departments. In fact, he thought they got shy of seeing Mr. Robb towards the end, because he (Mr. Canning) had never known him to return from London without the scalp of a Government official hanging to his girdle. This, however, was by the way. The members could not too strongly emphasize or act upon the points made in the address. In the first place, the Government had treated the industry abominably. The authorities made, as the President had told them, a desperate appeal to the industry during the war, and then not only did nothing to help it, but did much in the opposite direction. It was only the great vitality and inherent strength of the industry that had brought it safely through its trial. In the second place, the Government fostered electricity in every way they could, and in spite of the fact (as Mr. Madden had pointed out) that to carry out the same work, so much more coal was required in an electricity station, as compared with a gas-works. That this should have been done when the country was absolutely short of fuel, was a scandal; but doubtless if another war broke out to-morrow history would repeat itself, and they would be faced with the same conditions. It was ignorance which led the Government Departments to do what they had during the war; and this ignorance could only be met by endeavouring to enlighten the Government and the public upon elementary facts of science. He felt convinced that much could be done to remedy this state of affairs. During the war the electricians took advantage of this deplorable state of ignorance on the part of Heads of Departments generally, and simply hypnotized them. Every effort should be made to prevent such a state of affairs arising again; and in this connection he was sure they all fully appreciated the admirable work that was being done by the British Commercial Gas Association.

Mr. W. M. Mason (Manager of the British Commercial Gas Association), invited by the President to speak, remarked that he was very pleased to be at the meeting as a visitor, and had listened with great interest to what the President had to say. While

constructive criticism was a good thing, and should be welcomed, Mr. Robb must surely have been in a pessimistic mood when writing his address, as everything and everyone seemed to the President to be wrong. There was, though, one exception; for he was pleased to see Mr. Robb recognized, as they all did, that the National Gas Council were doing splendid work. As to the criticism that the British Commercial Gas Association were not interested in gas for lighting, this, he contended, was not correct; and Mr. Mason gave some interesting facts to prove his point. He maintained that the best means of retaining the lighting load was by demonstration and maintenance, rather than by display advertising. As to demonstration, they should show, with high-pressure and good lighting generally, what gas could do; while with regard to maintenance, there were towns in every part of the country where there was great room for improvement. Proper maintenance was an absolute essential to the industry if lighting was to be successfully held in the face of the competition of electricity. ["Hear, hear."] At the same time, it was wrong to say the "B.C.G.A." did not look after lighting. This subject was largely dealt with in their publication "A Thousand-and-One Uses for Gas;" and in other ways they were fully awake to the necessities of the case. Mr. Mason also referred to Mr. Robb's statement about the mediums used in connection with the "B.C.G.A." national publicity campaign, and pointed out that, though members could not possibly see all the advertisements, they were regularly appearing in the most important publications under various sections—such as educational, medical, architectural, society, trade, &c. He instanced a personal experience at Glasgow, when he found that "B.C.G.A." advertisements were regularly appearing in between eighty and ninety papers that were sold on the bookstalls there. The "B.C.G.A.," he pointed out, was not a one-man affair, but was a collection of the best brains in the gas industry. The whole policy was thoroughly discussed by the leading men of the industry.

The vote having been heartily passed,

The PRESIDENT expressed his acknowledgment. He went on to declare that he had not finished with the Government Departments yet, and that he had the best of reasons for his high opinion of the National Gas Council. What he had in mind when referring to the large advertisements of the "B.C.G.A." was that these advertisements were only looked at momentarily, and that paragraphs of a catchy nature would secure more attention. He also objected to confining the advertisements to a certain number of periodicals, and not giving all a turn. He, of course, agreed with the necessity for good maintenance, and did not think the Chepstow burners would be found to be very dirty.

PRESENTATION TO MR. THOMAS.

The PRESIDENT said he had now reached the most pleasant of all the duties he had to perform that day—namely, to call upon Mr. Canning, who was the son of their first President, the late highly respected Mr. Thomas Canning, to make a presentation.

Mr. CANNING said that, while he appreciated very much the honour conferred upon him in asking him to make this presentation to their old friend Mr. Thomas, he felt that really the President should do it. He wished his (Mr. Canning's) father could have been present that day, to see honour done to one for whom he had such affection and esteem as he had for Mr. Thomas. It was a comparatively easy matter to make this presentation, because the recipient needed no recommendation to them. As Mr. Browning had pointed out, it was proposed to form the Institution in 1905; the first suggestion coming from Mr. Edward Jones, who was at that time at Pontypridd. Mr. Jones had come to them a comparative stranger from the Manchester area; and naturally, having been used to attend the District Institution meetings there, he missed these regular conferences with his fellow managers when he got to Wales, and approached various influential people with the object of forming an association. It was formed; and not only Mr. Browning, but many others also, were doubtful of its success. However, a good beginning was made by the taking of a very wise step—that of selecting Mr. Thomas for the position of Hon. Secretary. From that day to this, the Institution had not only not looked back, but it had gone forward steadily, in spite of the war, until it had reached the strong position, both financially and in regard to membership, in which they found it that day. This result was almost entirely due to the steady work that had been put in by Mr. Thomas, and to his personality. In such a position as Mr. Thomas held, personality was, indeed, the main point. He had invariably been courteous to all, and had displayed absolute impartiality. In fact, to all he had been a personal friend—always ready to help in any difficulty. In making this little presentation, they were not only honouring Mr. Thomas, but they were honouring themselves. The following address had been drawn-up:

> To OCTAVIUS THOMAS, ESQ., Engineer and Manager of the Gas and Water Departments of the Rhondda Urban District Council, and Hon. Secretary to the Wales and Monmouthshire District Institution of Gas Engineers and Managers.
>
> Seventeen years have now elapsed since the foundation of the above Institution, during the whole of which period you have occupied the important position of Hon. Secretary thereto, and have untiringly devoted your energy and outstanding ability to furthering both the objects for which it was established and the welfare of its members. You have not only been conspicuously successful in the carrying-out of this splendid work, but you have voluntarily and cheerfully undertaken similar labours in connection with the many other Associations which have since been established for the promotion of the interests of the great industry in which we are so much concerned.
>
> It has been rightly felt by all those connected with gas undertakings in South Wales and Monmouthshire that they would indeed be lacking in gratitude if they failed to express to you, however inadequately, their high appreciation of your untiring efforts for their benefit, your zeal and energy in furthering the interests we all have at heart, and the unfailing courtesy and kindness which you have extended on every occasion to each and all of us.
>
> We therefore ask you to accept this album, together with a purse of notes, as a token of our gratitude, esteem, and affection; and we sincerely trust that in God's Providence you may be long spared to continue the worthy career which has reflected so much honour upon yourself and been productive of so many advantages to the gas industry in South Wales and Monmouthshire.
>
> Signed, on behalf of the members of the Wales and Monmouthshire District Institution of Gas Engineers and Managers, and other subscribers,
>
> JAMES ROBB,
> President.
> J. H. CANNING,
> Past-President.
>
> June 8, 1922.

[The illuminated address was contained in a handsome album, which Mr. Canning, amid loud applause, handed to Mr. Thomas, together with a wallet of Treasury notes.] This little testimonial, added Mr. Canning, very inadequately reflected the feelings of the members towards Mr. Thomas. It had been subscribed for by his colleagues, by some other friends in the district (of whom he had a great many), and by a number of gas undertakings. It was a token of appreciation of the services he had rendered for so many years, not only to their Institution, but to the industry generally.

Mr. THOMAS, in returning thanks, referred to the formation of the Institution, for which, he said, credit should be given to Mr. Small, of Merthyr Vale, who in the first place suggested it. So far as the work he himself had done was concerned, it had been a great pleasure. They were all brought into the world for service; and the more service they did for others, the greater pleasure they would have as they got on in life. He could never have carried on the Institution had it not been for the late Mr. Canning. Their kindness was really more than his efforts warranted.

The PRESIDENT said he had had a great many letters in connection with this matter; and every one spoke in terms of the highest praise of Mr. Thomas. Mr. Thomas's former chief, Mr. Henry Morley, wrote:

> I have a most intimate knowledge of his [Mr. Thomas's] character and qualifications, extending over a very long period of years; and being at present closely associated with him, I can fully testify to the detailed work it entails, and the time he gives unstintedly to the work. No one is more deserving of the recognition of his services you are about to make; and it is with the utmost pleasure I herewith enclose cheque for £3 3s. for the object you have in view, and I trust it will meet with the success it so thoroughly and richly deserves.

PLACE OF NEXT MEETING.

Proposed by the PRESIDENT, and seconded by Mr. MADDEN, it was agreed that it should be left to the Council to decide upon the place of the next meeting.

LUNCHEON.

The meeting then adjourned for luncheon, on the invitation of the Chairman and Directors of the Cardiff Gas Company. Mr. CHARLES E. DOVEY, J.P. (the Chairman of the Company), presided. After the honouring of the Loyal Toast,

The CHAIRMAN proposed "The Wales and Monmouthshire District Institution of Gas Engineers and Managers." He said the Company were delighted to have the Institution with them that day. These conferences were conducive to good management and efficiency in working; and the Company welcomed them to this meeting, held, as it were, under the wing of the Cardiff Gas Company. Co-ordination and interchange of knowledge and experience had a cumulative effect, and were of permanent and outstanding value to the gas world generally. They liked to put out of their minds as far as possible the late distressing war; but its consequences on gas working were destructive, and it seemed that in this industry, as well as in others, a lot of reconstructive work was still absolutely necessary. By their co-operation in dealing with fundamental matters of manufacture and management, much would be accomplished. If he might say so, these local conferences were potential. In a big general assembly, local conditions and difficulties were sometimes lost sight of; but here they had a more intimate association together, and could deal pertinently and effectively with the matters which more closely and immediately affected themselves. Faced with innumerable and untold difficulties, the gas industry had, he ventured to say, risen to the occasion. The energy and zeal of the British Commercial Gas Association and kindred organizations had been of inestimable value to all undertakings, both large and small. A good deal of educational and propaganda work yet remained to be done. Research work by the engineer and manufacturing chemist was still necessary, and developments would be carefully watched. He did not want to go unnecessarily into detail; but he was sure they would agree with him that all the elements and problems in connection with carbonization had not been exhausted, or the last word said. One could, perhaps, go into the problems facing the industry with regard to bye-products and vital questions of manufacture and sale; but he felt that the members were all keenly alive to the importance of these matters, and that they were daily receiving the very

careful attention they deserved. All gas undertakings were placed in positions of great difficulty; and with the materials on which they had to work, it was impossible to give to their customers all they would like to supply. The Government, through the Board of Trade—somewhat tardily perhaps—recognized the hardship of the position, with regard both to manufacture and finance. They had now, as it were, been given a new charter and constitution. Many anomalies had been removed; and they had greater freedom of action. But no privileges excepting those to which they were legitimately entitled had been granted. Theirs was a big and important industry; and they did not meet their responsibilities unless they had a full and conscientious regard for what was due to the consumer and shareholder. To those present and to all who helped by faithful and loyal service to produce wholly satisfactory results, the Directors, standing as they did between the interests of capital and labour, tendered their best thanks. There was nothing to fear so long as the industry had its liberty, and had not to encounter an unfair and unscrupulous competition. Their industry had its strength and vitality in its own usefulness; and they would never fail so long as they were true to themselves. He missed from this assembly the genial presence of the late Secretary of the Newport Gas Company. In all his attributes Mr. Hazell was a gentleman, and efficient in his business calling. His death was a distinct loss to the gas profession and to the community at large; for he had associated himself with many sides of life. With the toast he now submitted, he linked the name of their President, Mr. Robb. He knew him personally; and in choosing him as their President, the members had acted wisely, for his efficiency and zeal were undoubted, and he would guide them aright. Unfortunately, the Deputy-Chairman and other Directors of the Company were unable to be present to welcome the Institution. The Cardiff Gas Company were certainly progressive; and if there was anything to be seen at Grangetown which would be of service to the smaller undertakings, they would be glad. With the courtesy of Mr. Madden, they would have full explanations of all the latest improvements. The visitors owed their thanks to Mr. George Clarry, the genial and very efficient General Manager of the Company, who was delighted to do anything he could to render service to the industry. If their enjoyment had been enhanced by anything which had happened that day, they would pay tribute to Mr. Clarry's usual care, and the desire he always had to do things in the right way. He must also refer to the presence of their friend Mr. Mason, who was most devoted to the industry. He was glad the Institution had recognized the faithful service of another friend of his—Mr. Octavius Thomas, who had been a tower of strength.

Mr. ROBB, in reply, said the Institution were much bound-up with the Cardiff Gas Company, to whom they were indebted for innumerable kindnesses. He looked upon those connected with the Company as among the leading lights of the gas industry; and he hoped the undertaking would exist for ever.

Mr. CANNING remarked that very rightly the word "success" had been omitted from the toast which he had to submit—"The Cardiff Gas Light and Coke Company"—because the undertaking was already eminently successful, and they could only wish it continued success. The reasons for this success were manifold; but, in the first place, it was due to the fact that the Company's destinies had been presided over by enlightened and far-seeing Directors, who had adopted a policy calculated not only to meet the needs of the moment, but to lay broad and deep foundations for future prosperity. Then these Directors had been assisted by admirable officers. They had all very much for which to thank Mr. Clarry; and while referring to him, he would like also to wish Mr. R. G. Clarry success in his political career. It would be all to the good of the industry that they should have Members of Parliament who knew its needs and were able to instruct others accordingly. As to Mr. Madden, he did not think a gas engineer who was his superior in technical-ability was to be found in Great Britain. During the past twenty-five years, in spite of very keen electrical competition, the output of gas in Cardiff had practically trebled; and he thought they could look forward with absolute confidence to the future. He coupled with the toast the name of the Chairman, whose welcome they all appreciated.

The CHAIRMAN, in response, said he liked to hear the testimony to Mr. Clarry and Mr. Madden; and he wanted to say that they fully deserved it. He felt very deeply that in all they did they must try to meet the wishes of the consumers; for, after all, without the consumer there would be no gas company.

THE GRANGETOWN WORKS.

The party were then motored to the gas-works at Grangetown, which they subsequently inspected, under the direction of Mr. George Clarry and Mr. Madden, who, in explaining the many features of interest, were assisted by Mr. F. Boardman (Assistant Engineer), Mr. E. H. Clarry (Junior Assistant Engineer), Mr. A. E. Williams (Works Superintendent), and Mr. R. Taverner.

On reaching the works, a visit was first made to the war memorial near the entrance, erected by the Company in memory of elghteen employees who made the supreme sacrifice during the war. It is in the form of a bronze tablet on a white marble slab, and identical with one erected at the Bute Terrace Works. Passing on, evidence was soon forthcoming in plenty, in proof of the truth of the assertions previously made at the luncheon—that the Cardiff Gas Company is a progressive undertaking, and that the management is such as to ensure the retention by it of its place in the very front rank of up-to-date gas-works. The amount of new constructional work completed—with the difficult times of the war and its aftermath intervening—since the Institution visited the works in May, 1914, astonished the members, who also found plenty of other work now on hand. There are on the works, it should be explained, three complete sections of gas manufacturing plant, together with residuals plants. The coal is delivered into the works by five sets of high-level gantry railway, running the length of the retort-house coal-stores. The wagons are discharged by a number of hydraulic rams situated above the seven coal breakers and elevators.

The vertical retort section comprises fifteen settings of eight Glover-West retorts; the carbonizing capacity being 300 tons of Welsh coal per 24 hours. The coke is handled by a system of telpherage either to the yard or to the two sets of coke storage bunkers. This telpher also supplies coke to the carburetted water-gas plant overhead coke-bunkers, and breeze to the boiler-house. The whole of the section is electrically driven by current supplied from a power-house adjoining. Five electrical generating units are employed—gas-engines furnishing the motive power. The new work here since the last visit of the Institution comprises a further extension of five beds of eight Glover-West retorts, with an addition to the telpher, and the erection of a ferro-concrete coke-hopper. This extension provides additional carbonizing capacity of 1¼ million c.ft. per diem. The retorts are of an improved type, and have a somewhat larger throughput than those of the original installation. The members were fortunate in that their visit coincided with the time when five beds of retorts in the original installation happened to be undergoing re-setting, after seven years' continuous working. During the whole of this time, each retort has been carbonizing 2½ tons of coal per day, or 900 tons a year. They would have gone even longer; but it was felt that it might not be wise to face the next winter with them. The retorts are of Derbyshire silica, and were the first installation of this sort. They consist of 3-in. tiles, which have lost about 1 in. at the worst parts—that is, towards the bottom of the retort, where wear occurs. Mr. Madden is perfectly satisfied with his experience of this material.

In the horizontal house there are forty regenerative settings, each of eight retorts 20 ft. long, the carbonizing capacity being 430 tons per 24 hours. Since 1914 all the furnaces have been placed on one side of the house; and the previous machinery of the West compressed air type, which had been at work for fourteen years, has been superseded by two Fiddes-Aldridge electric stoking machines. The whole of the hoppers of the coal-elevating plant have consequently had to be placed on one side of the retort-house. The coke is handled by West coke-conveyors, and taken direct to overhead storage bunkers of 400 tons capacity. A second power-house supplies electric current and compressed air for the various requirements of this section of the works. The charges now worked are 9 to 10 cwt. per eight hours, as against 6 cwt. in six hours by the former West machines. The therm production is bigger in the vertical house than in the horizontal house; but taking both together, the coal gas made averages 64 therms per ton of Welsh coal, largely smalls; and Mr. Madden is hoping to do better. When he gets a supply of Yorkshire coal, his goal will be 80 therms. The Company's declared calorific value is 470 B.Th.U.; and the working instructions are: Calorific value, 485 B.Th.U.; specific gravity, 0·495 (not to exceed 0·510). In order to maintain this standard, the strictest possible chemical control is, of course, kept over the retort-house working.

Coming to the carburetted water-gas section, this consists of five sets of Messrs. Humphreys and Glasgow's plant. Another new piece of work which the members saw was the fifth set—a 2 million c.ft. a day unit, with waste-heat boiler, which has been erected on a fresh site. This new site offers greater facilities for handling material than the old one, which has of recent years become very congested; and so the four sets on the old site are now being gradually transferred alongside the new plant. As each set is so transferred, it is being re-modelled and equipped with waste-heat boiler. There is a temporary plant for starting-up the fans, and after that the heat recovered from the blast gases will be sufficient to provide the necessary steam for the whole plant and auxiliary machinery, pumps, &c. The blast gases will be washed, and the dust pass into a receiver. The coke and ashes will be handled by travelling cranes; the coke being stored in overhead hoppers running the full length of the house, and feeding direct by shoots into the generators. Opposite the new water-gas plant site another steel oil-storage tank has been constructed, of a capacity of 320,000 gallons.

Each section has its own condensing plant and washer-scrubbers. In No. 1 yard there are two sets of annular and two large water-cooled condensers, four tower-scrubbers, and two Kirkham, Hulett, and Chandler rotary washer-scrubbers. No. 2 yard comprises one set of vertical condensers, partly annular and partly water cooled, a Livesey washer, and two Holmes rotary brush-washers. This yard is at present being extended by the addition of a 4 million c.ft. a day Livesey washer, and another rotary washer-scrubber of 3 million c.ft. capacity of the Holmes type. With the soft water available at Cardiff, the cost of re-tubing condensers is a serious item; and the plan is being adopted of circulating the water over the outside of the pipes, by means of a pump and a water-tank beneath. Two of these Graham-type air and water cooled condensers, one for coal gas and one for water gas, are in course of erection by the Company's own workmen.

There are four sets of purifiers, each of six boxes. Two sets are on the ground floor, while the two other sets are elevated boxes filled by means of band conveyors—revivification taking place on a concrete floor underneath the boxes. A fifth set of boxes is now in course of construction by Messrs. C. & W. Walker. The tar dehydration plant, by the Chemical Engineering Company, has a capacity of 4000 gallons of crude tar per 24 hours. The sulphate of ammonia plant is by the same firm, and comprises two units, each of 4 tons capacity. An equipment

for neutralizing and drying the salt has recently been added to this plant; and the salt now produced contains practically 25¾ p.ct. ammonia. It is acid free and perfectly dry, and, as the members were able to see for themselves, in a very fine crystal condition. The Chemical Engineering Company are also responsible for a concentrated ammonia plant, of a capacity of 20,000 gallons per 24 hours. Another new piece of plant is a "Draper" washery, for the washing of coke breeze and pan ash material. This is by the Rhondda Engineering Company, Ltd., and is fitted with elevated ferro-concrete bunkers. The capacity is 50 tons per working day of eight hours. For dealing with retort-house ashes, Messrs. Head, Wrightson, and Co., Ltd., have installed a "Notanos" washery, which separates out the combustible matter for boiler use. It is fitted with elevated bunkers, and has a capacity of 50 tons per working day of eight hours.

An excellent new set of workshops has been completed and equipped with a fine selection of modern machine tools. These shops—for platers, smiths, carpenters, fitting, and wagon repairs—are all grouped together; and the old shops have been dismantled. Other work carried out since the last visit includes a garage and locomotive running shed for the housing of six lorries and two locomotives, and a new stores for the mains and services department. Among the new equipment are a locomotive by the Avonside Engine Company, a one-ton steam grab-crane by Messrs. Priestman Bros., Ltd., a loco-shunting crane and grab by Messrs. Grafton and Co., capable of lifting either 15 cwt. or 1 ton of coal per grab, and four "Sentinel" steam lorries, of 3 to 4 ton capacity, for yard work and coke delivery. In addition to the work in hand already mentioned are a rotary meter for measuring unpurified gas (but free from sulphuretted hydrogen), of a capacity of 5 million c.ft. per 24 hours, by the Rotary Meter Company; an elevated tar storage and loading tank of a capacity of 22,400 gallons, by Messrs. W. C. Holmes and Co., Ltd.; and the laying of a 12-in. high-pressure main from the works to Whitchurch, a distance of approximately 8000 yards, with a compressor at the works, to deal with 300,000 c.ft. per hour at a pressure of 15 lbs. per sq. in.

The social side is by no means overlooked, for attached to the works is a first-rate recreation ground of approximately 4½ acres, which is equipped with three tennis courts, pavilion, &c. The Company's Athletic Club caters for all kinds of sport and entertainment, and has a membership of approximately 700.

Gas Supply Classes.

After the inspection, the conveyances returned to town, for tea at the Bute Terrace offices of the Company, with Mr. George Clarry in the chair.

The PRESIDENT, after tea, proposed a hearty vote of thanks to the Company, and to Mr. Clarry and Mr. Madden, for all that had been done for the visitors during the day. The vote was passed with enthusiasm.

Mr. CLARRY said it always gave the Company and officers great pleasure to have the members of the Institution with them. The endeavour of the Company was to make gas as good as they could, and as cheap as they could. In their Act of last year they included some extensive clauses relating to co-partnership; and the employees were taking it up very warmly indeed. They had all made application to re-join; and the Company hoped in future to do very much more than they had done in the past under what was formerly a very limited co-partnership scheme. In exchange, they expected to secure from the men loyalty and good feeling towards their employers. At the wish of the Institution there had been started this year at the Cardiff Technical College a "Gas Supply" class. This had been going some months now; and, as Deputy-Chairman of the college, he was pleased to be able to tell them that there were a very promising lot of students. But new recruits were wanted; and he appealed for the influence of engineers and managers who might have an opportunity of bringing before their young men the advantages of attending the class. In this way they would secure far better service, and give more satisfactory results to the consumers.

A Proposed Junior Association for the District.

Mr. MADDEN said it had been a real pleasure to him and his staff to show the members round. As to the "Gas Supply" classes, he also appealed to members to put their backs into the thing, and help these classes. They might make gas cheaply; but then it had to be sold, and must be consumed efficiently. These things needed a good outside staff. They must all realize how much good these classes and the Junior Gas Associations did. Every man who had to meet the public, from the collector to the fitter's boy, should know something about gas and how it was made. The prosperity of every undertaking rested upon this. If only the Institution would back-up these classes, they would go all right. There was as yet no Junior Gas Association in South Wales; and they ought to have one. There was nothing more educative to the younger man than to be a member of a Junior Association. It was felt that the students of this year's class should form the nucleus of a Junior Association. Mr. Bell, the Outdoor Superintendent of the Cardiff Gas Company, had spoken to him on the matter, which he would like to see arranged. The classes would automatically feed the Junior Association; and benefit would result to the students, the consumers, and the companies concerned.

Mr. B. J. BELL was called upon, and referred to the good work done by the Midland Junior Association (with which he was connected for many years), and to the success that members had achieved in their careers. The Junior Associations had, he declared, done more for the gas industry than the gas industry realized. If the members of the Institution would support a Junior Association, and would guarantee in some way that every facility should be given to their subordinates for attending the meetings, the industry would gain a handsome return. He appealed to the Institution to take up the matter, and give the juniors a chance of forming an Association, so that the good work that had been done in this way in other parts of the country might be done also in their district. He was sure that all connected with the Cardiff Gas Company would do their best to make such an Association a success.

Mr. CLARRY and Mr. JOHNS promised to provide facilities for the holding of meetings in Cardiff and Swansea.

SELECTION OF COAL FOR THE TULLY PLANT.

By C. B. TULLY.

The four main species of coal are anthracite, carbonaceous, bituminous, and lignitous.

Bituminous Coal, or caking coal, is rich in hydrogen or hydrocarbons.

Lignites are rich in oxygen, and yield a great part of their hydrogen not as hydrogen but as water. They are non-caking, with a volatile content of over 45 p.ct.

Anthracites are non-caking coals with less than 10 p.ct. of volatile matter.

Carbonaceous Coals are intermediate between anthracite and bituminous coals, and are only slightly caking.

Inerts in Coal are mineral constituents present in the shape of ash, moisture in the coal, and inert substances in the volatile matter.

Volatile Matter may vary from 20 to 40 p.ct., and the inert matter evolved from 1 to 15 p.ct.

The melting point of the ash of a coal is a consideration of great importance in the selection of a suitable coal for the Tully plant. The lower the melting point, the greater the tendency to form clinker in the fuel bed, with loss of unconsumed fuel in the ashes, as during the formation of clinker coke is enclosed in the molten slag. Clinker blocks-up the space between the fire, prevents the blast getting through the fuel bed, and necessitates heavy labour costs and losses due to working time occupied in clinkering, together often amounting to many shillings per ton of coal. The minimum melting or softening point of a coal ash should be about 1400° C. If the ash consists wholly of silica and alumina, no clinker formation takes place; whereas iron and calcium silicates are very fluid when molten, and collect on the grate as a "matte" or clinker, which is expensive and laborious to remove. A mixture of two coals, one containing a non-fusible and the other a fusible ash, will often give more trouble, by the formation of clinker higher up the generator, than a coal containing a fusible ash alone. Hence, it is important to consider the clinkering properties of the coal before deciding upon its use.

The economic selection of a gas coal for use in horizontal or other retorts depends upon its gas-making and coke-producing qualities—usually the better the coking properties, the more costly the coal. But the selection of coal for the Tully plant depends mostly upon its gas-producing qualities. The coke produced need not be a marketable coke so long as it will work in the plant. The amount of ash in the coal does not matter very much so long as it is a non-fusible ash. Really, a very second-class coal may give the best results in the Tully plant. This is a very important matter to the gas industry, as it offers a selection of a wide range of cheap coals from practically any of the coal-fields. There are a number of suitable cheap coals that cannot be profitably worked owing to the want of demand. One of the great advantages of the Tully plant over any ordinary carburetted water-gas plant is the fact that it can use these second-class coals, whereas a carburetted water-gas plant requires a good coke from a first-class coal.

There are so many cheap and suitable coals available for the plant that it is better to avoid a highly bituminous caking coal, on account of its liability to sticking and forming a pasty mass in the generator and, generally, giving difficulty with the clinker. Very fine dusty bituminous coal forms a solid sticky mass in the generator, which neither air blast or gas will penetrate; whereas dust and fine from a non-caking coal goes through like coke breeze, through which it is impossible to get the blast. However, a judicious mixture of these coals, or a mixture of coke and coal, will often remedy the difficulty. A semi-bituminous coal can be worked containing a considerable amount of small, but requires patience and an exercise of a little experimental work. No plant will do physical impossibilities. Practical experience of the working of over 200 Tully gas plants has pointed to the fact that all coals differ more or less, and that each coal when used in the plant has its own economical gas of a certain B.Th.U. It may be anything from 350 to 425, varying as to the ratio between the fixed carbon and the hydrocarbon content of the particular coal—the higher the hydrocarbon content, the higher the B.Th.U. It is quite evident the fixed carbon can only produce H_2 and CO_2 gases of 321 B.Th.U. In selecting a coal for a high B.Th.U. yield, consideration should be given to the value of the coal in sperm per ton, which should be, as in the case of Scotch coals, between 800 and 1000 lbs. However, if the coal has not the necessary sperm value, it is more economically added in the shape of gas oil. As a matter of fact, with gas oil at its present price, it is the cheapest method of producing the therm in the Tully plant. It is not an economical proposition to try to get a high B.Th.U. gas from a low sperm coal; it is far better business to produce and obtain the extra B.Th.U. by the use of oil.

Gas Oil.—Owing to the cost of labour and other matters, gas oil is going to play a more important part in the industry than

ever. During the early years of the war, the writer was engaged with the late Prof. Vivian B. Lewes in the cracking of petroleum for the production of motor spirit. Our job was to procure motor spirit and toluole; and nothing else troubled us at the time. We concentrated our energies on this particular object; but some of the operators made more or less spirit, while others made more gas than spirit, and other troubles cropped-up. The war no doubt set us all working at our best at our own particular job, with one object only in view—that of winning the war. The metallurgist was busy making armour-proof steel for resisting explosives; the chemist was busy making explosives to blow to pieces the metallurgist's steel; and so on through the whole business of winning the war. Now, when we are able to think quietly of what the chemist, the metallurgist, the engineer, and the scientist did, we find that many of the things they did to win the war can be made to win the peace. For instance, in the metal the metallurgist invented for resisting steel shells we have a material that will make the gasification of oil for the production of gas a great economic success. Similar materials will enable us to do things which would otherwise be impossible. It will make possible the continuous production of water gas without the aid of oxygen, and revolutionize our present-day ideas of gas manufacture. The possibilities of chemical operations are mostly confined for want only of a suitable material of which to construct the necessary plant.

This is wandering away from the subject of a selection of coal for the Tully plant. However, when once we have leisure to analyze experiences gained during the war, and adapt them to present requirements, great things may be expected for the future.

THE "FUSION" PATENT LOW-TEMPERATURE RETORT.

By C. J. GOODWIN, A.C.G.I., B.Sc., A.M.Inst.C.E.

[Extracts from a Paper submitted to the South Wales Institute of Engineers, at Cardiff.]

Those connected with the development of plant for the recovery of oils from coal, shale, torbanite, or the like, are practically all agreed that reduction in size to (say) ¼ in. mesh is the first essential step in the process: (1) Because the yield of oil is increased; (2) because a lower retort temperature can be used, and there is therefore less risk of cracking and carbon deposit; and (3) because, if "smalls" have to be rejected from the material as mined or quarried, the delivered costs to the retort are increased according to the percentage of rejected material.

The other essential conditions for efficient and economical operation may be summarized as follows.

(*a*) The thickness of the layer of material in contact with the heated surface should be a few inches only, so that the oil vapours can be freely evolved; this, again, assisting in keeping down the temperature.

(*b*) The material during heat treatment should be continually turned over, and in such a way that at one moment it is in contact with the heated surface and at the next removed to the gas evolving zone or layer. This prevents overheating, and promotes free and regular evolution of gas.

(*c*) The temperature of the material should be gradually increased to its maximum over a period of not less than about 20 minutes.

(*d*) The retort should be so constructed that the heated surfaces can be kept perfectly free of scale or deposit, and further that caking of the material upon itself is prevented. If it is possible during treatment—and particularly in the early stages of the treatment—further to break-up the material so that fresh surfaces are offered to the heated surfaces, so much the better.

(*e*) The most controversial point seems to be the desirability of removing moisture from the material previous to the treatment for extraction of the oil. Tests have shown that moisture cannot be completely removed; and in dealing with a certain oil shale, it was found that, while the evolution of moisture began at about 150° C. and continued until the temperature was over 300° C., evolution of oil commenced at about 250° C. It would appear, therefore, that complete removal of moisture before evolution of oil is not feasible, however correct the principle involved. On the other hand, quite a number of experienced people claim—and with some grounds for their claim—that the presence of a small percentage of steam in the retort is beneficial, not only as regards yields, but also quality, &c., of the oil. The free moisture cannot be removed after the material is charged into the retort, unless the retort has sealed compartments; and in their absence, and in normal circumstances, a part of the oil would go over with the moisture, or part of the moisture would go over with the oil. In actual practice, therefore, only a portion of the free or mechanically combined water can be removed.

A study of current publications and patent literature shows that many attempts have been made to fulfil some or all of the above conditions. Rotary tubes with stationary scrapers, rotary tubes with rotary scrapers, stationary tubes with rotary scrapers, and many modifications and differences in detail have been employed and suggested. But it is obvious that in all such arrangements there must be a reasonable clearance between tube and scrapers; and this permits of the birth of scale. Ultimately the nose or end of the scrapers comes in contact with the scale; and the result is only too often an ideal brake, heavy power consumption, and probably after a few weeks of continuous running a bent or broken scraper shaft or blades. Apart from such breakdowns and the formation of scale, with resulting loss of heat, the scrapers so far devised fail to break-up the material if it cakes or "balls;" they do not fully break-up the material itself, or offer new surfaces for heat treatment; and, lastly, the tube itself is never free of scale or deposit.

In the "Fusion" retort there is no scraper action of the kind referred to; but the device gives a "chipping" action. The retort, in rotating, tends to carry the loose "star" or "cross" breaker with it, until a point is reached (which will naturally vary slightly) when the breaker falls back, and one point or edge of the star or cross comes in contact with the bed of material being treated, giving a chipping or hammer effect in the nature of a glancing blow. The power required for operating this breaker is extremely small, and can be closely ascertained by the fluctuations of the ammeter between the time when the breaker has just fallen over to the time just before it falls over again. Numerous readings indicate that for operating the breaker about 0·1 H.P. is required in a retort capable of treating an average of 4·25 tons per 24 hours. Contrary to expectation, the retort is not noisy in operation, particularly when a six-point instead of a four-point star is used. Similar types of breakers are used in the annular space between the retorts when necessary, or, alternatively, the inner tube is provided with external ribs and itself acts as a loose breaker. The arrangement necessitates a rotary tube or tubes. The outer tube is about 2 ft. 6 in. and the inner tube about 18 in. diameter. By using two tubes, only one gland is necessary; and there is the additional advantage that the oil shale during its initial or very delicate stage is only subject to indirect heating. Numerous experiments have shown that this is important.

Rotary retorts for the treatment of bituminous materials, cement, and other purposes, have usually suffered from, or failed through, the use of an ordinary gland, which is expensive, and very difficult to keep tight without undue friction. While the diameter of the tube at the end could be reduced so that a gland of less than 2 ft. 6 in. could be used, the serious difficulties and disadvantages of a gland nearly caused this type of retort to be abandoned, in spite of the advantages already described. The final solution was relatively simple, consisting of a diaphragm of thin sheet metal carrying circular corrugations for the purpose of giving extra flexibility, and carrying at the outer end a steel ring—springs keeping the latter in close contact with an asbestos compound ring placed upon the end tube.

The subjoined table gives the results obtained in a few typical trials carried out with the "Fusion" retort. Attention may be drawn to the relatively low carbon content of the residue, showing that "cracking" was practically absent.

Typical Tests with "Fusion" Retort.

Material Treated.	Esthonian Shale.	Nova Scotia Torbanite.	Australian Torbanite.	Kimmeridge Shale.
Gallons of oil recovered per ton of *undried* material (*exclusive* of oil recovered by scrubbing of gas)	73·6	51·8	131·7	52·5
Specific gravity of oil	0·921	0·849	0 854	0·980
Percentage of volatile matter in residue	4·96	6·10	13·95	6·85
Percentage carbon content in residue	10·6	9·50	26·0	20·1

NOTES.—With Esthonian shale the bulk of the oil came off between 275° and 450° C., and with Kimmeridge shale between 300° and 400° C. Tests on residue of Esthonian shale are sometimes misleading, owing to the presence of finely-divided limestone. With Esthonian shale, about 2360 c.ft. of gas of 894 B.Th.U. before "stripping" were evolved.

No difficulty is experienced in maintaining a steady gradient and the desired temperatures in continuous operation. The temperature of the oil vapour and gases leaving the retort averages about 250° C., and of the flue gases about 425° C. The gases from the inner tube do not, of course, pass through the annular space between the two tubes, the gases from which are at a higher temperature; and this arrangement and the ultimate mingling of the two streams of gas present obvious advantages. At present the waste heat in the flue gases is not being utilized; but their temperature is sufficiently high to render the installation of a waste-heat boiler remunerative in certain cases. Should partial pre-drying of the material be desired—and there may be cases where this shows a profit on the extra cost of installation—the heat in the flue gases may be utilized in a simple form of drier, a separate retort for this purpose being quite unnecessary. To remove part of the moisture from within the retort, though quite feasible, complicates the design and unduly increases the capital cost of the plant for a given output.

In the treatment of oil shale, torbanite, &c., a high recovery efficiency of oil is the main object; but in the case of coal or similar material, the objects are twofold—tars and coke or semi-coke. In the retort under review, the coke rejected from the plant will be in a finely-divided state, and therefore unsuitable for industrial purposes without further treatment. If coke or semi-coke dust firing becomes a commercial proposition—and there are already indications that it is—then we have a material which is

almost ready for such use. In fact, recent practice seems to indicate that intensive pulverizing is unnecessary. The residual products from this type of retort could be used with advantage in certain types of producer-gas plant; but if it is to be used as domestic fuel or for certain industrial purposes, briquetting would be essential, and some authorities claim that this would pay. Its application as a pulverized fuel probably requires further investigation before one can speak with any degree of certainty as to its commercial utility.

LOW-TEMPERATURE CARBONIZATION OF COAL.

By N. H. FREEMAN, BRITISH OIL AND FUEL CONSERVATION, LTD.

[A Paper presented to the South Wales Institute of Engineers, at Cardiff.]

The above title conveys to the mind a dual process for the carbonization of coal—one having a low temperature, another having a high temperature. Low-temperature carbonization requires an entirely different manipulation from high-temperature carbonization. While the end point of both systems, as far as the carbonizing effect is concerned, may be approximately the same, the route travelled and the resultant products are vastly different physically.

Carbonization of coal can have but one meaning—the increase of the proportion of carbon in the residuum from the carbonization treatment. This, then, is the aim conveyed by the title "low-temperature carbonization of coal." In reality, the term "low-temperature carbonization of coal" has been used to impart the idea of oil production, sulphate of ammonia recovery, and the manufacture of a smokeless household fuel. The idea has been promulgated that any and all coals are suitable for the production of all of the above—viz., oil, sulphate of ammonia, and household fuel—by the simple operation of low-temperature carbonization.

But what is low temperature, and with what temperature is it compared? What are the critical points, and what are the changes that take place? To differentiate between high and low temperature carbonization a critical point must be fixed. I fix that critical point at the temperature of dissociation of the hydrocarbons in coal composition—viz., 800° Fahr. (426·6° C.). This temperature is the high point of low-temperature carbonization. Beyond this point, the dissociation of the hydrocarbon molecule takes place, with a freeing of the hydrogen and a deposition of carbon.

The first step in low-temperature carbonization of coal is the removal of water. This begins at 212° Fahr. (100° C.), and carries on to 500° Fahr. (260° C.). There is another critical point in the heat treatment of coals which begins in most coals at 450° Fahr. (232° C.), and that is the metamorphosis or transformation of a great part of the coal from an insoluble into a soluble condition. This transformation continues to as high a point as 650° Fahr. (343° C.) in some coals; and it is only after such a transformation has taken place that a distillation of oil begins.

The education of oil from coal covers an exceedingly short range of temperature—250° Fahr. will cover the range from the beginning of oil-production to the finishing-point. (I am not including in the word "oils," tar, pitches, naphthalenes, anthracenes, or the phenols). During the transformation period, no gas or oil is distilled, and the retorting gives no evidence that any change of condition is taking place. It is only by taking samples and treating in a Soxhlet apparatus that a change in the structure of the coal is ascertained.

After the critical temperature of transformation is passed, the distillation period of the oils produced begins. The maximum point at which oils are distilled is 800° Fahr. (426·6° C.). Beyond this point, tars, pitches, naphthalenes, anthracenes, phenols, and like combinations are produced. The formation of tars, &c., is a phase of the carbonization of coal. It is, however, the low point in high-temperature carbonization. Whether a coal should be subjected to low or high temperature depends, first, upon the coal, and next upon the objective. If the objective be household or industrial fuel (other than furnace coke), the ash and volatile contents must be considered. If the hydrocarbon volatile is below 20 p.ct., the retorting for oil alone is not a commercial proposition. If the ash content is above 10 p.ct., a washing treatment is required before retorting; and the retorting temperature will depend upon the amount of hydrocarbon volatile in the coal after washing. If only a few gallons of low-grade oil are possible of production, the retorting temperatures need not be higher than are necessary for molecular transformation, which will materially aid in the formation of briquettes, and reduce the amount of binder required, if briquetting be the aim.

The production of so-called semi-coke cannot be considered as a true low-temperature carbonizing process, since the temperatures required to produce a coke with the necessary resistance to friability are very little lower than the temperatures necessary for the production of furnace coke. The aim of low-temperature carbonization of coal is the production of superior materials to the raw materials treated. These materials are oil (if the hydrocarbon volatile allows) and household or industrial fuel (other than furnace coke), or a soluble coal. Gas production by low-temperature carbonization, except in limited quantities, is entirely out of the question.

Coal being a poor conductor of heat, large masses in a quiescent state cannot be subjected to low-temperature carbonization treatment, since the coal nearest the source of heat will attain a temperature far greater than the coal in the centre of the mass, and the product will vary in hardness and character. All coke produced at low temperature is of a friable nature, and cannot compete with the briquette in resistance to friability, if the briquette be properly made.

To obtain regular carbonizing results by low-temperature treatment, the coal must be finely divided, in thin layers, constantly agitated so that every particle is subjected to the same temperature, and the temperatures must be automatically controlled. For economy, the operation must be continuous. Since continuity of operation is essential for economy, it is obvious that low-temperature carbonization cannot be conducted in a single chamber, owing to the difficulty of increasing the temperature of water at atmospheric pressure above 212° Fahr. (100° C.). Hence there must be an operation to remove the water. The transforming of the coal from the insoluble state to the soluble condition requires another operation. Then the distilling of the volatile matter formed is an operation by itself. After the distilling period, the residuum must be brought to a temperature at which it will take no harm when delivered into the atmosphere; and a cooling operation must be provided. For these various operations, several chambers automatically controlled as to temperature are required.

The definition, the aims, the requirements and methods of accomplishment of low-temperature carbonization have been given. There remains but to name an apparatus capable of following out the programme. There is a retort which answers to all the above, owned by British Oil and Fuel Conservation, Ltd., No. 5, Hythe Road, Willesden, who have submitted it to a week's continuous run, day and night, on carbonaceous material, with entirely satisfactory results.

THROUGH HORIZONTAL BENCHES OF SIXES.

Dealing with small coal-gas making plants, in a paper submitted to the Southern Gas Association of America, Mr. Vernon Baker, Chief Engineer and Vice-President of the Russell Engineering Company of St. Louis, said that half-depth benches of sixes, with stopped-end retorts, had apparently formerly met the various requirements better than any other; but with the coming into use of silica for retort-settings, higher heats became possible, which led to the increase of furnace capacities. The type of setting that meets the newer conditions more nearly than others, for plants which have outgrown the stopped-end retort-bench size, but have not reached the point where machine-operated benches are unquestionably the proper type to instal, is, he thinks, perhaps the "through bench of sixes." This type involves no great initial expenditure of money, requires no special supervision, and can be adapted to existing plants. When the number of times per day each retort is discharged is decreased, and more coal carbonized per foot of retort, the total actual labour is lessened, and the carbonization conditions are improved. There is a greater mass of coal placed in the retort and left in for a longer period; the gas as it is evolved from the coal and passes to the ascension pipe is exposed to a smaller area of heated retort surface; and the results are better quality and quantity of gas, coke, tar, and ammonia. It is also practicable to use a smaller size coal, if desired, or even a poorer quality, if necessary. As to the limits of output determining the feasibility of through benches of sixes, these are from three to eight benches, or an ultimate output of from 225,000 c.ft. to 650,000 c.ft. per day. Below the lower limit, it is more advisable to instal stopped-end benches, as no labour is saved in such a small plant of throughs. For an output over that which can be obtained from eight benches, it will be more economical from the labour standpoint to build larger units with power machines. In the benches referred to, the retorts are usually 11 ft. 6 in. long over-all, of standard cross-section 16 in. by 26 in., and constructed of silica, as also are the settings. Where the send-out permits the benches to be operated at full capacity, they show clearly that better gas yield and quality is obtained, and a much better coke, than from stopped-end retorts. The actual weight of charges varies from 520 to 750 lbs. per charge.

Distillation Principles and Processes.—We have received from Messrs. Macmillan and Co., Ltd., a copy of "Distillation Principles and Processes" by Dr. Sydney Young, M.A., F.R.S. The price of the book is 40s. net. A review will appear in an early issue of the "JOURNAL."

A Further Price Reduction at Bristol.—The Bristol Gas Company announce that as from the date of the meter readings for the June quarter, the charge for gas will be 9·2d. per therm, which is equal to 3s. 8·16d. per 1000 c.ft. It represents a further reduction of about 3d. per 1000 c.ft.; and a total reduction of nearly 10d. per 1000 c.ft. since December last. The declared calorific value is 480 B.Th.U.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

ANNUAL MEETING AT GALASHIELS.

THE Annual General Meeting of the Waverley Association of Gas Managers was held on Thursday last, in the Technical College, Galashiels—Mr. A. Dow (the President) in the chair. The attendance was little short of a record for recent years.

THE LATE MR. GEORGE HISLOP.

The PRESIDENT at the outset reminded the members that the present was the first meeting of the Association since the death of Mr. George Hislop, of Paisley. Since the deceased had ever been recognized as an eminent gentleman in their profession, it was fitting that the Association should incorporate in the minutes a reference to the loss that had been sustained through his death. Accordingly, he moved that a sense of their regret at Mr. Hislop's passing should be minuted, and an excerpt of the same transmitted to the members of his family.

The resolution was passed in silence, while the members stood in their places.

FINANCIAL AND OTHER MATTERS.

The PRESIDENT explained that a statement of the income and expenditure for the year ended April 30 last would be found attached to the agenda. Mr. John O'Halloran, the auditor, had examined the books and vouchers, and had found these to be in order. The income, including a balance of £29 19s. 10d. brought forward from the previous year, was stated to be £53 19s. 10d.; while the disbursements totalled £26 3s. 11½d.—leaving a credit balance of £27 15s. 10½d. in the hands of the Treasurer.

Mr. J. D. KEILLOR (Hawick), in moving that the accounts be adopted, repeated the suggestion made a year ago that a little more of the balance might annually be absorbed in the purchase of a more costly medal for the retiring President. He was prepared to move that a sum of at least £5 5s. should annually be expended in the acquisition of a medal of chaste design for the President.

Mr. HAMILTON (Loanhead) indicated that he was prepared to second Mr. Keillor's motion in so far as it provided for the adoption of the financial statement.

This part of the resolution was agreed to unanimously; and Mr. Chalmers (Kelso) seconded the second portion—that a sum of £5 5s. be earmarked each year for the purchase of the President's medal.

Mr. M. RICHMOND (Penicuik) moved the previous question.

Mr. DAVID VASS (Perth) pointed out that the present type of souvenir had been continued for between twenty and thirty years. They ought not to break this link with the past.

By a considerable majority the previous question was declared carried.

NEW MEMBERS.

New members were elected as follows: Ordinary, Messrs. Angus Cunningham, Bridge of Weir; J. M. Henderson, Lasswade; Laurence Farquhar, Peebles; Gracie, Edinburgh; Kincaid, Kirkcaldy; and H. Fairweather M'Nair, Grangemouth. Extraordinary Members, Messrs. D. B. Galloway, Glasgow; James Jamieson, Cambuslang; George Clark, Chesterfield; C. W. Macfie, Edinburgh; J. W. Broadhead, Elland; G. Tully, Coaltown-on-Trent; Fletcher (Parkinson Stove Company); and Christie, of Messrs. Walker and Cameron.

THE NEW PRESIDENT AND OFFICERS.

The PRESIDENT announced that the Committee had considered the question of President for the ensuing year, and the name they were prepared to put forward was that of Mr. Frank Welsh, of Duns. He moved accordingly.

Mr. R. J. PHILP (North Berwick) seconded the nomination, which was cordially agreed to.

On the motion of the PRESIDENT, Mr. R. J. Philp was unanimously re-elected President, and a tribute was paid to his consistently good service to the Association.

Other officials were appointed as follows: Members of Committee for two years, Messrs. A. Donald, Prestonpans, and R. Taylor, Aberlady. For one year, Mr. G. Urquhart, Tranent. Auditor, Mr. John O'Halloran.

THE PRESIDENT'S ADDRESS.

The PRESIDENT thereafter read the following address:

Gentlemen,—When a year ago you conferred upon me the high honour of electing me to the presidency of this Association—an honour for which I now beg to thank you—the country was facing an industrial upheaval of unprecedented magnitude. I refer to the coal crisis, which lasted for a period of thirteen weeks—a period which not only stretched the resources of the gas industry to the utmost, but imposed such conditions of distress and privation upon all industries and individuals of the nation that even to-day they have not made good the recovery which we all so earnestly desire.

For many years this Association has met under the cloud of tragedy and industrial strife and depression to an extent never before approached in the history of our land. The industrial peace and prosperity we were told to expect after the war has not yet arrived; but I am sure you will agree with me that it looms beckoning ahead, and that the spirit of a great hope is above it all. It is a glorious privilege, nevertheless, to have seen and lived through the intense trials of our nation, and as an industry to have taken some little share in the stupendous efforts the nation has been called upon to make in recent years.

At the close of another unusually eventful year in the life of this Association, during which circumstances have appeared to press with unwonted force against the development of the gas industry, it falls to my lot to address you; and a few desultory references may not be wholly without interest.

THE INDUSTRY DURING THE COAL STRIKE.

In the first place, and with your permission, I would briefly refer to the splendid manner in which the gas industry emerged from the coal strike of last year. Many very interesting experiences could be related in this connection—of the expedients, unusual methods, and practices adopted to eke-out the stocks of coal, conserve the limited supplies available, and thus maintain the supply of gas for all purposes. The ingenuity and skill displayed by individual gas engineers and managers, throughout the country, were highly commendable and praiseworthy. The strike proved the resourcefulness of the industry. Yet how little the general public appreciated the services rendered! Not until their bills were served upon them, in most cases, I fear, did they voice their feelings, and then in no complimentary way. Explanations of "astounding increases" were demanded, and more cuffs than courtesies were showered upon us. Such was my experience; and I have wondered whether the paradoxical situation was due to the proverbially short memory of the public, or whether it is not more aptly summed up in the words of our national poet:

> If self the wavering balance shake,
> It's rarely right adjusted.

But in the knowledge that we have done our duty—and, after all, it is no more than our duty to serve the public satisfactorily at all times—we can afford to extend our commiseration for the too easily engendered suspicions of the consumer.

Immediately after the coal strike, like many another professional brother, I had to run the gauntlet of a great deal of badly informed Press criticism—unfair and unreasonable criticism to say the least, and by no means the ordinary groanings of a disgruntled consumer. I am sure none of us object to wholesome criticism; and it is never profitable to turn a deaf ear to properly communicated and genuine grievances brought to our notice. In dealing with such, we must be thorough and always patient with our consumers; but when subjected to a campaign of calumny by a capricious Press with an irresistible penchant for notoriety, it becomes necessary to put before the public a true and unbiassed aspect of the position. How best can this be done?

I decided to lecture on the subject of "Gas and Its Uses;" and to a large gathering of interested consumers I explained in simple language the processes of manufacture and the many uses of gas for domestic and industrial purposes. By practical experiments I demonstrated the many causes of "bad gas," the importance of using proper appliances and their adjustment, and how to use gas to procure the best results and service. This lecture had the immediate effect of dissipating much of the evil engendered, and, in my opinion, is the best and most effective way of dealing with such a matter. "None are so blind as those who will not see." It is, therefore, incumbent upon us, as the present caretakers of the industry, to let pass no opportunity of correcting the slander that is much too frequently made upon gas, and of opening the eyes of the public to the truth and the facts.

Notwithstanding the admirable work of the British Commercial Gas Association, I consider it is not efficaciously enough backed-up by the industry and individual effort; and until this is done it cannot be truthfully said that the gas manager is adequately playing his part in the education of the gas-consuming public in the most economical way of using gas, the many duties it can be harnessed to perform, and its potentialities as a handmaiden to lighten the burden of the ordinary working-day. In large undertakings much work of this nature is being overtaken by specially skilled officials, whose duty it is to educate the public in the use of gas. In smaller establishments such work cannot be specialized or delegated to a special department. The departments are so inextricably connected that it must of necessity fall on the manager-in-charge; and he cannot do justice to his position without devoting much time and attention to this side of the business—still, he cannot afford to neglect it.

INEFFICIENCY OF GAS APPLIANCES.

Some time ago I was suspicious that some of the appliances on the market did not give efficient results under modern conditions, and to satisfy myself on the point I made investigations. Careful tests were made on different types of boiling ring, with the result that my convictions were confirmed. The following table,

showing the wide divergence in efficiency in the different types examined and tested, may be of interest:

Experiments with Different Types of Boiling Ring, Showing their Relative Efficiencies.

—	A.	B.	C.
Consumption per hour, c.ft.	12·75	12·75	12·75
Quantity of water	1 quart.	1 quart	1 quart
Cold temperature	47·5° Fahr.	47·5° Fahr.	47·5° Fahr.
Range of temperature	164·5° Fahr.	164·5° Fahr.	164·5° Fahr.
Time taken	7 min. 23 sec.	7 min. 30 sec.	9 min. 40 sec.
Gas used, c.ft.	1·418	1·557	2·100
Calorific value	475	475	475
B.Th.U. used	673·5	719·5	997·5
Pressure in inches	2·5	2·5	2·5

All flames correctly aërated.

It is evident, therefore, that the manager of small works must march with the times and keep himself conversant with the improvements that are made from time to time in all classes of gas appliances. By doing so he can exercise his latent commercial faculties to advantage; and it is surprising what can be done to popularize gas and profitably to increase its sale if the consumer is approached diplomatically and tactfully. Moreover, the gas manager should not hesitate to give his skilled advice and the benefit of his experience to consumers on subjects indirectly connected with gas-consuming appliances, which advice, when acted upon, would result profitably to the consumer. It should always be borne in mind that a satisfied consumer is usually willing to consider other propositions whereby he can save time, labour, and money by using gas, and thus becomes the megaphone of the gas manager.

Quite recently I had occasion to visit a consumer who had a large gas-engine in use. It came to my notice that a large quantity of steam was employed to heat water in connection with their business. The utilization of the waste heat from the gas-engine for this purpose had, apparently, never been thought of. I pointed out the fact that by the proper use of this waste heat practically 50 p.ct. of the water required could be heated. The coal bill for steam raising for this purpose approached £60 a month. Advice on points like this are of tremendous benefit to the consumer, and are appreciated, with redounding beneficial results to the gas producer.

THE CALORIFIC VALUE QUESTION.

With the passing into law of the Gas Regulation Act, discussions of late have centred very much round what is the most suitable calorific value to declare, and what benefits are to be obtained by the consumer under the new order. In Scotland, as elsewhere, we are divided into two camps—the high and the low calorific value supporters; and there appears no unanimity of opinion as to which is the better and more serviceable calorific value—few undertakings in Scotland having yet adopted the Act. Perhaps the Scotsman's innate sense of caution has something to do with this; but is there not a possibility that this cautious policy of "wait and see" may result in our industry being caught in a chaos of indecision? Let us remember that our decisions to-day, either understood or expressed, may become the laws of to-morrow; and, accordingly, as our decisions are right or otherwise, so shall we advance or retard the progress of the industry.

On the question of declared calorific value, many factors come prominently into action, which materially affect the cost of producing the therm. A few of the primary conditions are, I think—

1.—Manufacturing plant available.
2.—Value of residuals.
3.—Labour costs.
4.—Distribution conditions.
5.—Cost of coal.
6.—Maintenance.

As these conditions are bound to fluctuate in every works, it follows that the individual manager must review his own local conditions and thereafter work out his own salvation by deciding which calorific value will be the most economically produced and give all-round efficiency in his own case. Under the new order, the consumer will pay for heat units delivered. This raises a question which local conditions will again decide—viz., the loss of B.Th.U. between works and consumer. In our own case, where the works are situated over two miles from the town, and the distribution system comprises upwards of thirty-six miles of mains, I have found the loss in calorific value during travel to amount to as much as 10 B.Th.U.

Having regard to all the foregoing factors, I had tests made on the vertical retort plant in order to discover what calorific value would most effectively suit local conditions. From these tests the following table was compiled—taking cost of coal and yield from residuals at local prices, wages from coal wagon to coke-store, and including supervision of machinery. In calculating the cost per therm, I may mention that coke available for sale under the different calorific values produced is a very important factor. During the period of these tests, I may state we had a greater number of complaints of "bad gas" with gas of 500 B.Th.U. than when a lower calorific value was supplied. What does this point to? It would appear that the public judge us by the light obtained from their incandescent burners and the performance of their cooking and heating appliances, irrespective of quality.

Table showing Cost of Therm Produced at Different Calorific Values.

	A	B	C
Coal carbonized, tons	307	482	429
Gas produced, c.ft.	5,860,800	7,797,300	5,838,300
Gas made per ton, c.ft.	19,090	16,176	13,141
Calorific value, gross	410 B.Th.U.	475 B.Th.U.	500 B.Th.U.
B.Th.U. per ton	7,826,300	7,683,600	6,570,500
Therms per ton	78·2	76·8	65·7
Cost of manufacture per therm, pence	2·57	1·66	1·97
Duration of test	1 month	1 month	1 month

To them, therefore, a B.Th.U. of 400 gas is as good as a B.Th.U. of 500, provided the inerts are kept as low as possible. I am no advocate of low calorific value obtained by high inert content. From our scientific knowledge of the facts, and with personal experience of vertical retort gas of 475 B.Th.U., incandescent lighting is very much more brilliant than when 500 or 550 B.Th.U. horizontal retort gas containing a larger percentage of unsaturated hydrocarbons is supplied. We know that flame temperature is the factor which brings about this result, and it is quite evident that the consumer is obtaining a better all-round efficiency with gas below 500 B.Th.U. Does it not, therefore, appear absurd to supply a higher luminous gas when it is remembered that 90 p.ct. at least of the gas supplied is put to use for lighting, cooking, and heating purposes under the principle of the bunsen flame?

SHORTCOMINGS OF COAL SUPPLIERS.

As a penalty is attached in the Act on the gas producer if he fails to maintain the declared calorific value, it hastens the day when gas undertakings must, of necessity, formulate improved methods under which our raw material, coal, is purchased. We have all had experience in past years of a material being delivered to our works under the disguise of coal, and of the difficulties and troubles created. The present method of buying coal is vague and unsatisfactory. Little or nothing has been done by the collieries to classify or grade the coals, and frequently have I seen good gas coal, abounding in cannel, on sale at depots for domestic purposes, when gas managers were strenuously endeavouring to manufacture gas from coal high in foreign material and ash and low in volatile matter. As an example of the laxity of the collieries in this respect, I may relate that quite recently my interest was aroused in a certain class of coal which was claimed by the colliery people to be "highly suitable for gas-making purposes." Being desirous of investigating this claim, I went further into the matter and asked for fuller particulars, only to be disappointed by being presented with an analysis twenty years old. Surely this in itself is condemnation of the present effete method of selling coal on an out-of-date quantitative basis; and it is obvious that the gas industry must supersede these old methods by new and efficient ones, if they are to protect themselves against the shortcomings of the coal suppliers.

Statistics grading and classifying the coals in different areas according to their calorific value, composition, ash content, &c., based on recent and authoritative analyses, would be of inestimable value to the manager of the smaller works, who finds it impossible, through lack of apparatus and assistance, to carry out a qualitative test at the works. I throw out the suggestion here that this important work might be undertaken by the National Gas Council and other associated bodies, with the fixed conviction that if it were it would constitute a great step forward in the ultimate progress of the industry. The resulting table, which could be revised (say) every five years, would give the gas manager a definite basis on which to choose and purchase his coal, without having to rely upon an out-of-date analysis for his information.

The ideal conditions of a standard quality of coal being delivered from day to day are, of course, unattainable; and it is necessary that our carbonizing plant should possess a certain amount of flexibility to deal with the inevitable fluctuations in the raw material, and maintain an approximately standard product in the face of these adverse conditions. Moreover, it is more essential than ever that we should have strict and careful supervision of our distillation processes in order to preserve a smooth continuity of operation, and prevent as far as possible the necessity of spasmodic burdens being placed on our carbonizing plant, with their consequent detrimental effects on the quality of the finished product.

PRODUCER FURNACE DESIGN.

With the advent of vertical retorts and other refinements in the realm of carbonization, the duties of the gas stoker have been completely revolutionized, and one might be justified in saying that the only really arduous job that remains is the clinkering of producer furnaces. When our vertical plant was installed, it was found necessary to clinker the furnaces every two days at least, entailing hard manual work. From the very first it was obvious to me that if we were going to reap the advantage of verticals in the way of labour-saving and preserve smooth continuity of operation, it would be necessary to have the producer furnaces remodelled to enable them to deal successfully with Scotch coke, which has characteristics and tendencies dissimilar to English coke. The original furnace was of the step-grate type with the addition of furnace bars placed close together at the bottom of the fuel bed, the preheated primary air entering through two nostrils at the back of the furnace. The combination of these

two factors was the chief cause of clinker formation. The exceptionally close firebars necessary to retain the Scotch coke prevented the ash finding its way freely enough to the ashpan, with the result that the zone of combustion crept upwards; and this was then aggravated by the primary air short-circuiting, causing local heating and fluxing the ash into masses of clinker. My contention on producer furnaces and their working has always been that they should be so designed as to prevent the fluxing of the ash into clinker, rather than to make arrangements for its removal after formation.

Having diagnosed the trouble, it became necessary to design the furnace on new lines, in order to fit it into the new brickwork. With the hearty co-operation of Mr. J. W. Broadhead (of Messrs. Robert Dempster & Sons, the contractors) and his technical assistants, and after months of careful thought and experiment, a furnace was designed which, I thought, would solve the problem. The primary air was conveyed by ducts below the ashpan to the front of the furnace, the angle of the step-grate was altered, the firebars were done away with, and steam and water supplies were so arranged that the furnace temperature could be controlled at will at all points of combustion. In addition to this, the internal structure of the furnace was reconstructed, so that the bridging of the coke from the step grate to the producer-gas offtakes would be eliminated and the fire move freely downwards.

How far this has been successful in overcoming our troubles may be judged from the fact that we have absolutely eliminated the formation of clinker in our producers; it is easy to maintain any desired temperature in the settings from day to day without variation; and it is unnecessary to false-bar the furnace for cleaning-out purposes. The duties of the attendants, however, are so organized that, as a matter of routine, bars are inserted once per month for inspection, though there is little or no call for it. The furnaces have been in continuous use for 460 days, and the walls are still in perfect condition.

As I have previously stated, it is imperative that our carbonizing processes should go forward as regularly and continuously as possible. Our vertical retort plant is certainly a great success in this respect, results being consistently good; and with slight variations the plant responds almost immediately to the ordinary adjustments for the varying classes of coal. Choked off-take pipes, pitched hydraulics, and hanging-up or running charges are things unknown to us. It is also apparent that the efficiency of the extractor device is of a very high order, when I tell you that during the strike period we carbonized, as an experiment, non-coking dross and 50 p.ct. of sawdust without the slightest sign of the charge slipping. A visit to the works in the afternoon has been arranged, and you will have an opportunity of inspecting the plant.

RESIDUALS AND COMMERCIAL SECTIONS.

During the past year the values of residuals have fallen considerably, the drop in sulphate of ammonia prices being exceptionally regrettable, as it was out of all proportion to acid prices and cost of manufacture; and gas managers found it more profitable to run their production of ammoniacal liquor to waste than to work it. Coke prices fell considerably; and it is regrettable that certain undertakings found it necessary to resort to dumping practices in other areas. This only emphasizes the need of more understanding and co-operation between our Commercial Sections, and proves the necessity for the individual manager's giving the fullest possible details on his monthly return, so that the section as a body will have some clearly defined basis on which to take action

In concluding this address, I may say it has not been my object to compile a connected or specialized treatise on any particular aspect of gas production, but rather to flit from one subject of current interest to another, in the hope of provoking a good discussion and a free expression of opinion, which I trust will now ensue.

DISCUSSION.

Mr. JAMES D. KEILLOR (Hawick) said with reference to the criticism the President was subjected to by his local Press, it was altogether uncalled for. No manager of a gas undertaking would object to any wholesome and reasonable criticism of his individual methods, policy, or practice. Constructive criticism was always welcome, because it was helpful; and managers appreciated it, believing that they could find benefit from it. On the other hand, when they were subjected to disparaging dope and destructive criticism by one not possessing any technical knowledge of gas-works practice, and who artfully arranged and exaggerated reports to the deprecation of an important public service, it was never right to allow such tactics to pass unchallenged. As a matter of fact, something more severe than their commiseration was called for. By lecturing to his customers in the way he had explained to them in his address, the President had adopted a dignified and effective way of dealing with the matter. It seemed to him that no gas manager should hesitate in sending out an "S.O.S." to the British Commercial Gas Association when confronted by a similar situation. The President's advice to managers to keep abreast of the times was both good and sound. It did seem to him, however, that it had been rather misdirected, and that it would have been better addressed to certain committees and directorates of gas undertakings. In some instances the latter were prone to pursue a short-sighted policy, and were somewhat heedless of their responsibilities and duties, not only with regard to their own individual undertakings and the requirements of the consumers, but to the industry at large. Managers of such concerns could not always be blamed for the lethargy of their companies or for the niggardliness and cheese-paring policy of their employers. So far as the new gas regulations were concerned, he had nothing to say except that these had been accepted by the industry for better or worse. It simply remained for the individual to find out for himself what calorific value he could produce most conveniently, and what appeared to be most economical and suitable for his local requirements. Speaking as a manager of a non-statutory company, he would say that they intended in Hawick, for as long as they were permitted, to sell gas on the old basis. They supplied a calorific value of 400 B.Th.U., and had fully confirmed its practical utility for all purposes. Nothing higher in calorific value was necessary in his opinion; and he was satisfied that better efficiency was obtained with gas of this standard than with a make of a higher calorific value. He ventured to suggest that they were approaching the time when gas and air adjusters and all attachments that were never understood by, and were always considered an abomination to, the consumer would be abolished. The results of the President's experiments with different types of boiling burners bore out his personal experience; but manufacturers of gas appliances ought not to be castigated for this. Manufacturers of such appliances were of great assistance to them, and everyone must appreciate the efforts they made to produce appliances that would give the minimum amount of trouble in the hands of the consumer. Every improvement in the construction of gas-burners that led to increased efficiency—more light for present consumption or less consumption with the present light—added to their knowledge of economic facts and affected the discovery of methods for cheapening the manufacture and supply of gas. Standardization of calorific value, which would result in the elimination of all adjusters, would be to manufacturers a very considerable relief. It would be an easy matter for the manufacturers to supply fittings accurately adjusted and suitable for the varied qualities of the gas produced. Their adjustments were, after all, only approximating the theoretical; and in his own case, although the suppliers were familiar with the calorific value standard and pressure in Hawick, there was never an appliance delivered to them there but had to be readjusted when put into the hands of the consumer. The President had voiced his (Mr. Keillor's) own opinion by saying that it was absurd to supply gas of high illuminating power where the burners were entirely on the bunsen principle. At Hawick, the flat-flame jet had been completely abolished; and, after all, as the President had very pertinently pointed out, one B.Th.U. was as good as another to the consumer so long as the light obtained and the action of the cooking, &c., fittings were giving satisfaction.

Mr. M. RICHMOND (Penicuik) said their President was very optimistic regarding the future of gas supply. He hoped that prophecy would be fulfilled, but it occurred to him that at the present moment things did not appear to be so bright as Mr. Dow was inclined to represent them. The President thought it would be interesting to have a recapitulation of the expedients which were attempted during the period of the coal strike to eke-out the stocks of coal and conserve the limited supplies available. These expedients, it seemed to him, represented merely a continuation of those to which managers responsible for gas undertakings were of necessity forced to resort during the war. Unfortunately to his mind, these were expedients that had a tendency to bring down the quality of the gas. It was a regrettable circumstance that some managers were displaying a tendency to stick to these expedients. He hoped such a spirit would be eliminated as speedily as possible. Of much interest to the members of the Association was the table Mr. Dow had incorporated in his address showing the results of experiments with different types of boiling ring. It was a peculiar circumstance, when they came to analyze the relative efficiencies, that gas of the same calorific value should, under column C, be shown to have used a considerably greater amount of gas, while the time taken to boil represented quite 30 p.ct. more. His own experience in connection with boiling-rings was that it was not so much the quality of gas that affected the result as the distance of the kettle from the hottest part of the flame. Better results could always reasonably be expected if they could get the tip of the flame impinging on the bottom of the kettle than when the latter was too far away from the flame or too close to it. So far as the question of calorific value was concerned, the President appeared to think that a great deal depended on the manufacturing plant available. Incidentally, Mr. Dow had enumerated six primary conditions which ought to operate in regard to declared calorific value. No doubt consideration of the manufacturing plant available would be of importance in the smaller type of gas-works, but the same sort of thing could not be argued in works of the magnitude of the South Metropolitan Company, for instance, where they were in a position to scrap their plants at any time. Not only so, but many of the other larger undertakings, as a result of their experience, had increased the calorific standard so that, after all, the consideration that weighed with them could not have been the manufacturing plant available. Experience had brought home to those responsible for the larger undertakings the knowledge that the higher quality of gas gave by far the best value all round. He agreed with the President that coal analyses had considerable utility. At the same time he was afraid the hint Mr. Dow had thrown out with a view to getting statistics grading and classifying the coals in different areas according to their calorific value, composition, ash content, &c., would not be of much practical effect. The trouble was that these analyses were invariably based on samples which could not be said to agree with the general bulk supply of coal at all. In connection with Mr. Dow's trouble with clinker, it appeared to him that the whole thing had been a matter of adjustment of the steam and water. Proper adjustment of steam and water in any furnace would obviate clinker trouble to a great extent. It was a pity that prices for residuals, liquors, &c., were such that a deal in regard to them could not be made a profitable investment. To a great extent the railway companies were to blame. Until the railway rates were substantially reduced, he feared managers would find it difficult to dispose of their residuals and liquors on an economic basis.

Mr. CHARLES FAIRWEATHER (Kilmarnock) said the first point he noted was the President's observations relative to the recent coal strike. Those of them who had occasion to move up and down the country during the period of the strike must have found many different methods of continuing the gas supply. Already, he regretted to say, the good work done by many managers during those critical weeks

had been forgotten. In his own district (Kilmarnock), they had many difficulties to overcome. Latterly, they entered into an arrangement whereby the Electricity Department and his own Department ran in conjunction. The two together bought up bings of round dross here and there—in fact, wherever such fuel could be found. They sent out their own men to do the filling into the railway wagons. That round dross proved to be, after all, quite a good method of maintaining the gas supply; but, of course, the coke they derived from it was not particularly usable. He fully agreed with what the President had said on the subject of complaints regarding bad gas. It had been remarked by the President and others that the unfortunate prices at which residuals were selling were detrimentally affecting the position of the gas undertaking. This was undoubtedly true, because coke and sulphate of ammonia were selling at extraordinarily low prices. He supposed many of the members had seen the critical statements which were being made in the newspapers relative to the continued use of tar for road making. In pre-war days tar was regarded as a very useful agent for maintaining roads in good condition; but in the light of recent experience, a changed view was being taken by the road authorities. It behoved them then, as gas engineers as well as tar distillers, to give the closest attention to the subject, because they must all be desirous of retaining tar as a permanent constituent for road-making purposes. Generally speaking, the drawbacks to tar as a constituent for road construction were that it provided hard roads in winter, and soft and sticky surfaces in hot weather. Further, there was one element that was entering into the question, and that was that in many instances the road surveyors were not properly treating the thoroughfares with tar. An unduly large proportion of tar to metal had a bad effect: but if surveyors would see to it that the tar and metal were judiciously mixed, their troubles would be minimized to a great extent. Despite these precautions there still remained the undisputed fact that tar would soften; and the position seemed to be now that bitumen was being seriously considered as a constituent in road making. He believed that experiments would be gone into on this subject; and he had hopes that in the near future a good road-making material could be supplied consisting of refined tar (say No. 1 tar) and a judicious percentage of bitumen. If experiments could be successfully developed along this line, it would help to solve the present-day problem of road making.

Mr. DAVID VASS (Perth) observed that a great deal had already been said in the discussion on the matter of complaints. If, however, they looked at the question fairly, they might be surprised to discover that there was generally in the background a cause for complaint. In taking up his own appointment some years ago, he had a particular complaint brought under his notice. He referred it to the foreman, who remarked, "Oh, that one is always complaining." He quite frankly told the foreman that they had got to find out in the first instance if there was any cause for complaint. They must get to the bottom of the thing. His instructions were followed out; and it was found that, in the case in question, there was just cause for complaint. He had, naturally enough, the suspicion that, previous to his taking a hand in matters, all such complaints had been treated in that cavalier fashion. All complaints ought to be fairly and freely investigated, because it was possible that there might be one genuine grievance among the lot; and the one thing essential was to get that genuine grievance remedied as speedily as possible. In the early days of cooker demonstrations, they were able to get occasionally into closer touch with the customers, and to give them useful hints as to the right way of using gas. Now that these demonstrations were not so much in vogue as formerly, there was just the fear that the gas manager might get a little out of touch with his consumers. For this reason he felt that the President had gone on right lines in organizing the lecture he had given in Galashiels. It was a policy such as this that possibly many more managers had got to pursue. Touching upon appliances, and the troubles which not infrequently arose therefrom, he would call to mind a complaint that reached him respecting an appliance which was installed in a baker's premises for the purpose of keeping food warm. The complaint was that the appliance was not giving satisfaction at all, and the grumble went a bit further than that even, because it was represented that the same arrangement was operating under similar conditions in another town and was quite a success. Therefore, it was inferred, the gas in the area for which he (Mr. Vass) was responsible must be bad. On investigation, it was found that the particular appliance was not standardized; and the whole trouble was the one to which Mr. Richmond had referred in the course of the discussion—the distance which the flame was away from real contact with its work. No doubt it was a simple matter of readjustment, but the fact remained that the whole district was being blackballed since it was represented that the gas locally was bad, because the same arrangement was capable of giving satisfactory results elsewhere. He had been very much interested in the President's experiments with boiling burners; and it seemed to him that similar tests might be carried out with cooking appliances. Lately he had made several trials with different kinds of kettles, and it was astonishing to note the variation of results. From a lot of kettles he selected one of the old-fashioned type that used to be on the market with a view to being located in front of a gas-fire. He discovered, for instance, that this type of kettle, when used for boiling water, took four or five times longer than the ordinary flat kettle. Yet this was a type that was boomed most extensively as economical and saving in gas. This little instance served to show that they must study the interests of their consumers by testing all the appliances they were going to use—even, in fact, to the vessels and utensils to be utilized in cooking if gas was the heating agent. In fixing the declared calorific value, the lines most of them would wish to follow would be to study, in the first place, what the consumers had been in the habit of using. In most districts appliances were specially adjusted to the needs and customs of the consumers. Therefore he felt that, in the first place, they should endeavour to give the gas-consuming public what they had been accustomed to. If it was found that a higher calorific value would be the more economical to manufacture in a district, alternatively, that the lower calorific standard proved cheaper, they would doubtless have to adjust their appliances accordingly; but in the first place the policy most of them would take would be to give customers what they had been in the habit of receiving in the way of facilities. If they did not do so, he feared they might be up against trouble if they were suddenly confronted or faced with a heavy outlay for an adjustment of appliances to meet a higher or a lower calorific value standard than they had been in the habit of supplying. He had been a little surprised with the results obtained by the President as set forth in columns A, B, and C in the table showing the cost of a therm produced at different calorific values. While there was found an increasing calorific value from A to C—as borne out by the latter column it rose to 500 B.Th.U.—there was, on the other hand, a decreasing therm value per ton of coal on the same ratio, with a corresponding fall in the cost. He wondered if the President could explain this anomaly. The question whether 400 B.Th.U. was as good as 500 B.Th.U. was apt to have misleading results, and to bring managers to wrong conclusions. He had been somewhat struck with the arguments for testing coal the President had adduced in his address; but he feared there would be difficulty in arranging tests on a national basis. The difficulty was that one colliery not a quarter of a mile away from another might have a different grade of coal altogether; and before they could reach anything like finality in their conclusions, they would require to have an analysis of the coal from every colliery in the country.

Mr. GEORGE KEILLOR (Greenock) said that as a community the town he represented was absolutely immune from complaints. They had a system in operation by which all complaints were methodically recorded, and yet it was surprising to note the few complaints they did receive. So far as Press criticism was concerned, he had found it to be distinctly advantageous, when he took up duty in any new area, to cultivate right away a friendship with the representatives of the Press. He had a good sound talk with them; and his experience had gone to show that pressmen were always willing and ready to help if they were approached in the right way and in the proper spirit. In his office at Greenock he kept a list of the names of pressmen and reporters in his area, and he made a point of sending regularly to the newspapers, as well as to the public libraries, copies of all the information that percolated to him from the "B.C.G.A." and other channels. So far as calorific values were concerned, it was something of a mistake for people to say that 400 B.Th.U. gas was better than 500 B.Th.U. gas, or *vice-versâ*. The President had enumerated six primary conditions which might be regarded as determining factors in deciding the declared calorific value of gas; but it seemed to him that the fourth on the list, "distribution conditions," did not count for very much. So far as the sixth—namely, maintenance—was concerned, he did not think those who supplied lower-grade gas would find their maintenance charges becoming any higher. It had not been proved so in Greenock, at all events. Of course, he took it that the word maintenance meant, as the term rather implied, all-round maintenance. A good deal had been said and written recently about the deterioration of meters, and he had himself been wondering how that came about. Quite recently in Greenock he went to the trouble of taking off from the district rounds some two or three dozen meters. These he had thoroughly examined and tested, and he found that meters fixed in 1914, and in daily use since, were as good to-day as eight years ago. Then he had taken out meters fixed six months ago, and his test revealed that they were as good as those installed in 1914. Thus their experience in regard to meter deterioration had been a singularly pleasant one. His contention was that 410 B.Th.U. gas did not destroy meters in Greenock; and if this was the state of affairs there, it ought not to destroy meters elsewhere. There must be some other cause for this meter deterioration. If there was a minimum of free oxygen and a minimum of carbonic acid in the gas supplied, there would be no further trouble.

Mr. H. H. GRACIE (Edinburgh) said that on the subject of complaints Mr. Dow had referred to the proverbially short memory of the public and their proneness to complain. There was, however, another side—namely, as to the proportion which these complainers bore to the whole gas-consuming public. In a large community such as Edinburgh, this proportion was really very small, and the complaints were generally local. Again, they found that when complainers were properly attended to and matters put right they were generous in their thanks and good advertisers of gas in the future. In reference to the Press, he had found when he approached Press representatives and took pains to explain the difficulties to be contended with, they were most reasonable and sympathetic, and gave prominence to the facts. Mr. Dow had touched upon the very important subject of the efficiencies of gas apparatus, and he believed it was only within recent times that makers had become fully alive to the possibilities and needs in this direction. He had also given a few comparative figures which were very instructive, but they would have been even more valuable if he had worked out the actual percentage efficiencies. In this direction they themselves had been carrying out a series of tests on various boiling rings and cooker hotplates and incandescent burners with different qualities of gas, and so far as they had got at present the results showed that with proper adjustment as high efficiencies, and sometimes higher, could be got with gas of 490 to 500 B.Th.U. as with gas of lower grade down to 450 B.Th.U. They had indeed already obtained over 62 p.ct. efficiency with an up-to-date boiling ring. The gases used in the tests were from mixtures of straight coal gas and blue water gas in varying proportions. With the incandescent burner on the average of the tests there was a slight increase in the number of B.Th.U. used per candle as the quality decreased. It was, however, too soon yet to dogmatize, as different results arose with different burners, and the tests were still being continued. This raised the question of a standard burner; and in fixing a definite standard for gas, he thought it was up to them to let the public know which type of burner would give the best and most economical results with the gas supplied and at the prevailing pressure, and to stock that burner alone. On the subject of coal, in many works the question of the selection must be largely determined by the proximity of the works to the coalfields; the matter of railway carriage playing an important part in arriving at the cost of manufacture. There was also to be taken into account the type of plant available, and the suitability of various coals must be determined in relation to this. In Edinburgh they had been making exhaustive tests of all coals offered for gas-making, with a view to preparing a selection for

purchase; and in doing this they had ascertained the quantity of gas made, the calorific value per cubic foot of gas and per ton of coal, also the weight of coke, the percentage of ash, and the suitability for firing purposes in the producers. From the figures arrived at they had made up a valuation of the various coals in relation to one another; and by fixing a standard of (say) 100 for a certain class of coal of which they had large experience, they calculated the percentage value of all the others, and so determined how much more or less per ton they were justified in paying after taking everything into account. Having compiled this information, they compared their daily results with those from the test plant, and in nearly every case they were able to secure additional heat units in the retort-house, in some instances of a substantial amount. This formed a quick and reliable test of the working. It had occurred to him that many of these figures would be most useful and helpful to their less fortunately placed brethren, and he would be pleased to give the results, in confidence and for personal use only, to any manager using a particular class of coal which they had tested in Edinburgh in the way mentioned. They were manufacturing gas of value 500 B.Th U. in a two-stage process—that was, from straight coal gas (made in inclines) mixed with water gas; and they were able to produce from the combined plants from 78 to 80 therms per ton of coal. They had been subjecting their coals as received to a very severe scrutiny: and this had resulted in greatly improved quality and freedom from inert and foreign matter. They had also resorted from time to time to hand picking a wagon of coal, and by forwarding their figures to the collieries had succeeded in reducing the quantity of foreign and useless matter to under 1 p.ct., in some cases to as low as 0·3 to 0·4 p.ct. In handling large quantities of coal, the necessity of such precautions would be at once apparent. Before leaving the subject of coal testing and Mr. Dow's reference to this matter being taken up by the National Gas Council, his idea was that H.M. Fuel Research Station was put up with a view to ascertaining the value of all classes of fuel from a gas-making, steam-raising, and fuel conservation point of view; and when his Committee and he visited these works some time ago, Sir George Beilby informed them that statistics were being compiled and would be published from time to time. In regard to the Gas Regulation Act, a good deal had been said in reference to the delay in adopting it, especially on the part of municipal authorities; and it had been argued that the delay suggested they were afraid to adopt it, as it was likely to be to their disadvantage. On the other hand, if they waited until the Board of Trade compelled them to adopt it, the consumers would probably think they were having something imposed upon them to their advantage. The truth was, however, that in a municipal concern where the gas was sent out in accordance with a calorific standard Order, and where no profits were made, there was little advantage either way in adopting the Act or not. The general feeling among engineers of the larger works was that they should all go forward together. In any event, it was desirable to make the change-over in the method of charging by the therm at the beginning of a financial year. It was also advisable to have the staff trained-up to think in therms, and many of them found it rather difficult to make the change from cubic feet. At the same time the problem facing them all was—what calorific value were they going to declare? So far as he could see at present, this figure would approximate to the calorific value at present being supplied, as, after all, this value must be one which they could maintain the whole year round. Consequently, the plant available for the purpose would largely influence the choice. The market for residuals had also an important bearing on the most economical value to produce. At the same time they were gathering experience from those who had gone forward; and it was significant to note that many were already applying to have their calorific value increased. This suggested that they thought it would be more advantageous to send out their gas in more concentrated form; and as long as this higher grade gave as good efficiency in the appliances as the lower one, and the price tended to come down, the change would be in favour of the consumer. Most of them were meantime carrying out observations and tests to ascertain which would be the most efficient and economical grade to make and distribute with the plant already available, or with slight modifications. A little time ago, he had a statement prepared showing the undertakings which had gone forward for the Act, and he found that these were mainly companies; only three corporations in England and none in Scotland having secured the Act. Of these, 92 p.ct. had declared between 450 and 500 B.Th.U., 6 p.ct. from 400 to 450, and 2 p.ct. from 500 to 550; the average all over working out at about 470 B.Th U. He was rather surprised to hear that Mr. Dow had experienced such a large drop as 10 B.Th.U. in his calorific value. In Edinburgh, their works were somewhat similarly situated, and they had made repeated tests about 4½ miles from the works and found only a very slight drop—indeed, on some occasions they found an actual increase. He should therefore like to ask Mr. Dow what the quality of the gas was which showed this depreciation, and under what conditions the tests were carried out?

The PRESIDENT, replying to the discussion, said that his address had been written with the sole object of eliciting the views of the members of the Association; and he was glad there had been such a general response. Mr. James Keillor had been insistent on the point that committees and boards of Directors should keep abreast of the times. He agreed with this; but he was prepared to go a step further, and to say that if the gas manager himself was keenly alive to the progression of the hour, it required no strong effort on his part to influence his committee or his directorate in the same direction. Mr. Richmond appeared to think he was disposed to be rather optimistic in his views regarding the future of the gas industry. Taking it all over, he thought the industry was progressing rapidly. He was glad that the members had grasped his point in regard to boiling-rings. What he wanted to bring out most clearly was the question of the construction of appliances. Makers ought to make a point of studying the position of the flame; they must make certain that the maximum flame was provided at the point of real contact. He had been pleased with the observations that were made on the use of tar for road-making purposes. In hot weather, such as they were experiencing at the moment in Scotland, roads which had been laid with tar got into a very messy condition. A state of things had crept in which was rather objectionable, and he feared that road surveyors had departed to some extent from the old lines of road making which proved quite successful even when tar was used. Some years ago in Mr. Fairweather's district in Ayrshire he used to admire very much the condition of the roads. He agreed with Mr. Vass that when complaints were received, they should fully investigate them and exercise patience towards the consumers. Personally he was always willing to give consumers the fullest measure of attention, if they came to him straight away with complaints. As a matter of fact he had done so in the past, and he had followed on the principle that if a second complaint came from the same source, he saw to it that the matter received his personal attention and investigation. It had been a pleasant experience for him to meet the gas-consuming public at the lecture which he organized in Galashiels. It was altogether a most successful meeting; and it had given him wonderful encouragement to develop this policy a little more in the future. Mr. Gracie had driven home the point in reference to an analysis of the coal that he had been aiming to get at. If a large corporation like Edinburgh could take up this question and come to the assistance of the managers of smaller undertakings who, in the matter of analyses, were bound to be struggling in the dark, it would be an incalculable boon. It was very kind of Mr. Gracie to make the confidential offer he had done; and he would be pleased, seeing he was in a district somewhat close to Edinburgh, to take advantage of the facilities tendered. Mr. Keillor, of Greenock, had made an interesting contribution to the discussion, and from what he had revealed to them on the matter of meter deterioration it was evident that he must have in his gas in Greenock a very low oxygen content and CO_2. He had found the Press on the whole a delightful body of men. Like Mr. Keillor, he had made a point of cultivating the friendship of every pressman he had come across. He was friendly with the Press still in Galashiels; but the difficulty there was in getting the representatives to visit the works and see things for themselves at first hand.

PRESENTATION TO THE RETIRING PRESIDENT.

The business meeting was afterwards brought to a close with the presentation to the retiring President of the gold medal of the Association.

Mr. R. J. PHILP, North Berwick, as the immediate Past-President, made the presentation, which was feelingly acknowledged by Mr. DOW.

THE LUNCHEON.

The members of the Association subsequently adjourned to the Masonic Hall, where they were entertained to luncheon by the Chairman and Directors of the Galashiels Gas Light Company. Mr. James Sanderson, the Chairman of the Company, presided; and he was supported by Provost Dalgliesh, of Galashiels.

Mr. CHAPMAN (the Secretary of the Company) in a felicitous speech, proposed "The Waverley Association," which was responded to by Messrs. M. RICHMOND and DOW. Mr. J. O. SCOTT (Messrs. Alder and Mackay) proposed "The Town and Trade of Galashiels," and Provost DALGLIESH suitably replied. Mr. JAMES D. KEILLOR gave the toast of "The Galashiels Gas Light Company." Mr. JAMES SANDERSON, in replying, said it might be of interest to the members of the Association to know that the Galashiels Gas Light Company was founded in the year 1833. The progress of the Company, however, necessitated the acquisition of a larger site which was found at Galafoot, where the existing works were built. The local Company had, therefore, existed for 89 years.

VISIT TO GAS-WORKS.

THE DEMPSTER-TOOGOOD VERTICAL RETORT INSTALLATION.

Immediately after luncheon, the members of the Association were driven in motor char-a-bancs to the gas-works, which are situated in the district of Galashiels known as Galafoot. Interest centred round the recently installed setting of Dempster-Toogood vertical retorts; and the members were fortunate in being able to get at first-hand a detailed description of the plant from Mr. Toogood (of Messrs. Robert Dempster and Sons, the designers). Mr. Dow explained to the visitors on reaching the works that in the second week of January, 1920, a setting of 48 horizontal retorts was demolished and arrangements made for installing a vertical retort installation with a capacity of half-a-million cubic feet. It was unfortunate that when operations commenced, the country was beset with labour troubles; but despite these drawbacks the contractors—Messrs. Robert Dempster and Sons, Ltd., of Elland—did splendid work in completing the job only some seven weeks or so behind scheduled time. The first gas from the new plant was manufactured on Nov. 28. The completion of the undertaking was most opportune, because the Galashiels Gas Light Company were then drawing upon the last of their resources so far as manufactured gas was concerned. Of course, at the outset, one or two hitches occurred, and they had on one or two occasions to revert to the horizontals as a stop-gap. Once the initial difficulties were successfully surmounted, however, the verticals had remained continuously in action, and were giving complete satisfaction. What delighted him was the automatic movement of the plant, and, in striking contrast to the old type of horizontals, the silence with which the verticals operated. Mr. Toogood thereafter lucidly explained the outstanding features of the installation. After a complete and thorough inspection of the works, the members were driven back again to the Masonic Hall, where tea, also generously provided by the Galashiels Gas Light Company, was supplied. Altogether the day's programme was a varied and instructive one, and Mr. R. J. Philp, the Secretary, and the officers of the Waverley Association must be congratulated on the conspicuous success which attended the 1922 meeting.

LOW VERSUS HIGH TEMPERATURE CARBONIZATION FOR THE PRODUCTION OF SMOKELESS FUEL.

By E. R. SUTCLIFFE, Wh.Ex., A.M.Inst.Mech.E., and EDGAR C. EVANS, B.Sc., F.I.C., M.Inst.Min.E.

[A Paper read before the South Wales Institute of Engineers, at Cardiff.]

As the result of the considerable research work that has been carried on for many years by a number of observers, the various problems associated with the low-temperature carbonization of coal are one by one approaching a solution. System after system is being evolved which offers possibilities of meeting the conditions necessary for technical success; and the principal question involved in investigating the possibilities of a well thought out scheme is now becoming not so much "Will it work?" as "Will it pay?"

The question is not always an easy one to answer, even when most of the factors involved are fairly clearly understood; and perhaps the simplest method of approaching the problem is to compare low-temperature carbonization in one or other of the systems advocated with high-temperature carbonization. Modern conditions of high-temperature carbonization in gas-retorts or coke-ovens, do not, perhaps, allow of an absolute comparison being made. The ideal aimed at by low-temperature carbonization is to produce a smokeless, free-burning fuel, which can be ignited readily, and which will burn freely in the ordinary domestic grate, and which is yet hard enough and strong enough to withstand customary conditions of handling and transport.

Gas coke—despite the very energetic propaganda of the gas industry, and despite the efforts now being made to improve it—cannot be considered an ideal domestic fuel. In order to burn it successfully in the average English domestic grate, very great care must be taken with it. But this was not always the case. The authors are constantly being informed by men who knew the gas industry thirty or forty years ago that the gas coke of those days was a much better product than it is to-day—that is, regarded from the point of view of the domestic user. This observation is made frequently by the older school of highly-trained scientific observers; and it is therefore not a question of prejudice. It is, further, not altogether a question of temperature. Higher heats are used to-day in the gas industry than at any period of its history. The main consideration to-day with the gas engineer is not the candle power of his gas—the introduction of the incandescent mantle has rendered high candle power unnecessary—but of the therms he can get per ton of coal. To get his therms as gas, he works his retorts generally at the highest possible temperatures his materials will stand. Still, the difficulty of burning present-day coke as compared with the coke of the past is not due entirely to the high heats now used. There is, after all, not much difference in the type of coke produced at 950° C. and that at 1150° C.; and the higher heats employed to-day do not account for the difference between present-day gas coke and that (say) of thirty years ago.

In the few cases where the authors have been able to get accurate first-hand evidence, the works in which a good domestic fuel was produced in gas-works practice were works in which particular attention was paid to the candle power of the gas, and where to secure a high candle-power gas they used a good deal of cannel coke. The coke from many cannels, even though made at high temperatures, was excellent free-burning fuel. Low-ash cannels, however, have now almost disappeared in this country, as essential constituents in gas-retort mixtures; but a similar state of things exists to-day in some of the works abroad. The Calcutta Gas-Works, for example, compete in the bazaars of that city with native-made low-temperature coke as a free-burning domestic fuel; and this coke is made in absolutely modern gas-retorts, worked at the highest possible temperatures. The combustibility of a carbonized fuel is, then, not so much a question of temperature as of the character of the coal carbonized. Some coals when carbonized at high temperatures give a free-burning fuel, others do not—Why?

If an examination is made of the coals from which a high-temperature free-burning coke can be produced, it will be found that they invariably consist of coals which contain very little resinous matter, and which do not fuse or swell during the process of carbonization. If a lump of coal of this type is examined, the coke produced is very porous; but its structure is entirely different from the sponge-like character of ordinary blast-furnace or gas coke, and resembles charcoal rather than coke. The pores are very small in diameter, and are to a great extent continuous through the coke mass. Further, this coke is not impregnated with the graphitic film which covers ordinary gas or furnace coke, and is a principal cause of its incombustibility.

In a recent paper before the Society of Chemical Industry,* the authors endeavoured to show that the principal factor involved in the combustibility of coke is not the temperature of carbonization, but the character of its structure, combined with the absence in the body of the coke of the refractory graphitic film referred to. It is all a question of carbonizing under such conditions that a coke is obtained of a structure and character approaching more nearly that of charcoal than of furnace coke. Such a coke can be obtained by briquetting the coal without a binder under suitable conditions, and carbonizing these briquettes in any suitable carbonizing system. This means to say that a free-burning domestic smokeless fuel can be produced in any existing gas-retort or coke-oven, worked, if required, at any degree of temperature from 600° to 1000° C.

Since smokeless domestic fuel can be produced either at high or low temperatures, it becomes of importance to consider which of the two systems offers the greatest commercial advantages. In order to compare the economics of high and low temperature carbonization, the following comparison has been made of the yields from:

(*a*) A typical low-temperature carbonizing retort.
(*b*) A typical continuous vertical retort used in the gas industry.
(*c*) A continuous vertical internally heated retort.

COMPARISON BETWEEN HIGH AND LOW TEMPERATURE CARBONIZATION.

Yields of Products.

Yields per Ton of Coal Carbonized.	Low-Temperature Carbonization.	High-Temperature Carbonization.			
	Average.	Average London Works.	Continous Vertical.	Continuous Vertical with Steaming.	Internally Heated Retort.
Gas (c.ft.) . . .	3000	12,500	12,000	22,000	10,000
Coke (cwt.) . . .	15	14–14'5	14	14	14
Tar (gallons) . .	20	10	12'5	20	20
Sulphate (lbs.) . .	12'0	25'6	30	30'4	30–40
Benzole or motor spirit (gallons) .	2 to 2'5	..	..	..	2'5 to 3'0

The above figures are typical of the results obtained under modern conditions.

(Steam used in results shown in column 5 = 22 lbs. Pressure through $\frac{1}{8}$ in. orifice.)

The following points are brought out by these tables:

(1) By steaming continuous vertical retorts, a tar yield can be obtained equal to that obtainable by low-temperature carbonization.
(2) The net coke yield from ordinary continuous verticals is in the neighbourhood of 11'5 cwt.
(3) No benzole yield is shown in gas-retorts, because in normal gas practice this is not eliminated from the gas. A yield of from 2 to 2'5 gallons of benzole can be obtained per ton of coal carbonized.
(4) By gradually heating the coal to its maximum temperature in an internally heated retort, a maximum yield of ammonia and tar can be obtained.
(5) Assuming that the main product required was coke and not gas, the retorts could be heated by 5000 c.ft. of gas, leaving the remainder as surplus. The whole of the coke would thus be left for sale.

Taking customary conditions of vertical retorting practice, and comparing it with low-temperature carbonization, we get the following relative yields and values:

—	Low-Temperature Carbonization.		High-Temperature Carbonization.	
	Yield.	Value.	Yield.	Value.
Surplus Gas . . .	*Nil*	*Nil*	7000 c.ft.	3s. 6d.
Coke . . .	15 cwt.	..	14 cwt.	..
Tar . . .	20 gals.	5s.	12 gals.	4s.
Benzole . .	2'5 gals.	6s. 3d.	2'5 gals.	6s. 3d.
Sulphate. .	14 lbs.	1s. 9d.	30 lbs.	3s. 9d.

N.B.—The value of the surplus gas is taken at 6d. per 1000 c.ft.

Total value of bye-products.

(1) Low-temperature carbonization, 13s.
(2) High-temperature carbonization, 17s. 6d.

Under these conditions, the slightly increased yield of coke obtained by low-temperature carbonization is more than counterbalanced by the decrease in the value of the bye-products. Further, the increased coke yield is considerably reduced in value owing to the greater proportion of breeze that is obtained in low-temperature carbonization compared with high-temperature carbonization. Again, by carbonizing coal under such conditions that it is only gradually heated-up to its maximum temperature, it is possible to obtain as high a yield of tar as is obtained with low-temperature carbonization, and still retain the advantages of a high-temperature coke. With these conditions, the advantages claimed for low-temperature carbonization, in so far as the production of a smokeless domestic fuel is concerned, should be very carefully scrutinized, in comparison with those of high-temperature carbonization.

In some cases, low temperatures can be used to advantage; in other cases, high temperatures will hold their own. It is a matter

* See "JOURNAL," May 24, p. 439.

depending entirely upon local conditions, due allowance being made for the following factors:

(1) Relative market prices of small coal and smokeless fuel.
(2) Market value of bye-products produced. Special attention must be paid in this connection to the possibility of disposing of, at a profit, the surplus gas obtainable by high-temperature carbonization.
(3) Character of the fuel obtained by the particular process investigated—hardness, density, proportion of breeze produced, &c.
(4) Relative capital costs of the plant required.
(5) Relative working costs of the processes—particularly the labour costs.
(6) Space required by the plant.

These factors have all to be taken into consideration, apart entirely from the technical questions involved. It has been assumed all along that this aspect could be satisfied by the plant selected—that it could, with the coal used, produce a smokeless fuel of good quality. Naturally this would be the first point to be investigated; but after ample evidence had been produced to show that a particular system could handle the particular coal treated, it would be necessary then to consider very seriously indeed the claims of high-temperature carbonization.

It is no use being dogmatic. Every case must be considered on its own merits. But since a free-burning high-class smokeless domestic fuel can be obtained by high-temperature carbonization, it is of the utmost importance that a detailed comparison be made from a personal knowledge of the various factors involved.

The Importance of Quality.

Mr. Oscar H. Fogg, Secretary-Manager of the American Gas Association, in an address to the Gas Sales Association of New England, remarked that generally speaking the success of any merchandizing effort is judged by the sales profits made and the turn-over of stock. The ordinary department store can be taken as an example of sales effort based on these two factors. But there must be a different major consideration underlying any merchandizing effort on the part of the gas industry. Sales profits or stock turn-over should not form the foundation in the gasman's case, for basically underlying his whole merchandizing fabric is the object of increasing the sale of gas. The gasman's primary purpose in any sales effort must be the extension and development of business through the sale of appliances purely on their value as utilizers of gas. Therefore he is selling for the future—more than the immediate sale is at stake. This means that the appliances sold must initially conform to the highest standards of gas utilization, and, furthermore, must go on performing efficiently for an indefinite period—rendering useful service and bringing in revenue long after the sales transaction has been forgotten. In the matter of quality, he went on, the gas industry has not yet fully overcome the tendency to follow the line of least resistance—the human trait of taking the easiest way. No one will deny that it is easier to sell the lower priced of two articles, when both—to all appearances, and especially to the purchaser—are very much alike. But no one can sustain the claim that it is good business for the gas industry from any point of view to permit the sacrifice of quality in order to provide the inducement of low price and easy sale. It is time that the intelligent gasman took a firm stand in this matter—an unqualified stand in favour of quality goods.

Staveley Gas Company, Ltd.—At the annual meeting of the Company, it was announced that for the second year in succession no dividend was being paid. Mr. J. E. Roberts moved that the balance-sheet and Directors' report neither be received nor adopted, but that a Special Committee be appointed, with power to engage an expert and an independent chartered accountant to investigate thoroughly the position and prospects of the undertaking, and report to a special meeting. The Chairman (Mr. F. Hardwick) opposed the resolution, which was ultimately lost by his casting-vote. Afterwards the report and balance-sheet were adopted. The resignation of the Secretary (Mr. T. Till) was announced; and it was resolved to place on the minutes a record of appreciation of his services. Mr. H. Riley was appointed Secretary.

Co-Partnership without a Bonus.—The following is taken from the June issue of the "Co-Partnership Journal" of the South Metropolitan Gas Company: The prospect of a revival of the co-partnership bonus suggests to us the desirability of referring to the outstanding fact that our system has emerged triumphantly from the crucial test of a prolonged suspension of profit-sharing. Since 1917 there have been no surplus profits, so none could be allotted to the workers. Ever since our co-partnership has been before the public, there have been prophecies of its complete breakdown if bad times came along and the workmen had nothing entered in their pass-books. This has been the case for years, and everything else in the co-partnership has been maintained unimpaired. Never have the Co-Partnership Committee been a greater power than in this post-war period; never have the relations between Company and co-partners been more intimate and cordial. While other companies have amended their schemes to "keep alive" a bonus, we have held to the principle that standard dividend was on the same plane as standard wages, and that profit-sharing began when there was a surplus of profit beyond that necessary to meet those charges. Our co-partners have understood the position, and have risen to the occasion.

REGISTER OF PATENTS.

Improvements relating to the Manufacture of Illuminating Gas.—No. 164,310.

SOCIÉTÉ DU GAZ DE PARIS, of Rue Condorcet, Paris.

No. 12,228; April 28, 1921. Convention date, June 4, 1920.

This invention relates to the purification of illuminating gas, and has for its chief object the withdrawal of sulphuretted hydrogen and hydrocyanic acid. As is well known, this chemical purification may be effected by passing the crude gas over a solid material known as Laming's material, obtained by the action of a solution of ferrous sulphate on quicklime previously slaked. The mixture, to which sawdust is added for absorbing water and imparting a suitable porosity, is used in a dry state in suitable tanks. The two impurities of the gas are simultaneously absorbed in it; and subsequent treatment allows of the extraction of the cyanogen compounds from the spent purifying material, which is rich in sulphur.

In accordance with the present invention, chemical purification is obtained by the action of the mixture used in two distinct stages, so that the two essential impurities are absorbed separately and distinctly. In a preliminary "liquid" stage the crude gas is acted upon by a mixture of a solution of a ferrous salt and quicklime in the form of milk of lime; the mixture being sufficiently liquid to flow readily into a washer. On coming out of the washer the liquid portion is separated by a filter press, and the solid residue (after having been exposed to the action of the air) is mixed with sawdust, and is used dry—as in the method hereinbefore mentioned, but in this case merely to complete the purification of the gas which has already been passed through the liquid stage. This second part of the purification constitutes the "dry" stage.

In the liquid stage, provided the mixture of the solution of ferrous salt and of milk of lime is effected without exposure to the oxygen of the air (that is to say, for example, inside the washer), and also provided the quantities of iron and alkali present are suitably proportioned, the cyanogen in the gas will combine to form prussiate of lime, and remains in solution; part of the sulphuretted hydrogen of the gas combining with the excess of iron hydrate to produce iron sulphide, which remains in the solid residue.

From the filter press, therefore, the whole of the cyanogen compounds pass out in the liquid; and the solid residue, when exposed to the air to dry, absorbs oxygen and forms a purifying material of ferric hydrate mixed with sulphur, sulphate of lime, carbonate of lime, &c. To this material sawdust is added to give it a suitable porosity; and it can then be used dry in the ordinary tanks. The gas passing through these tanks, after having been deprived of its hydrocyanic acid, has only to give up what remains of the sulphuretted hydrogen. The absence of any cyanogen compound, on the one hand, and the molecular condition of the material obtained in the manner above described on the other, render the solid purifying material more active for the elimination of the sulphur than that obtained directly by the old method.

The proportions of iron salt and of alkali should be in the ratio of one molecule of iron salt to three molecules of lime at least. This proportion of lime may, however, be increased without inconvenience. The quantity of iron required evidently depends on the amount of hydrocyanic acid and sulphuretted hydrogen in the gas; the proportion suitable for use being the same as in the dry method of purification previously referred to.

Atmospheric Burners.—No. 178,886.

ROUSE, E. E., of Newquay.

No. 35,708; Dec. 20, 1920.

This invention relates to atmospheric burners for gas or oil, and can be applied (for example) to the water-heater described in specification No. 145,213. The object is to provide an improved form of burner in which provision is made for effectively mixing gas and air, for preventing blowing-back of the flame, and for deflecting it in such a manner that the calorific power of the fuel is utilized to the maximum.

The burner is formed by a cylindrical mixing chamber above which is disposed a member of mushroom form adapted to co-operate with the upper edge of the chamber to produce an annular flame. Within the chamber is disposed a coned member formed of wire gauze, the base of the cone being secured beneath or adjacent to the base of the mixing chamber, while the apex of the cone reaches approximately to the level of the upper edge of the chamber. The lower end of the mixing chamber is open, and communicates with a chamber having suitable air inlets, while a gas or vapour inlet projects upwardly through this lower chamber into the base of the mixing chamber. The gas inlet is preferably a cylindrical passage into which projects a member having a coned surface and so disposed that the gas passage is gradually constricted towards the top.

Prepayment Meters.—No. 179,267.

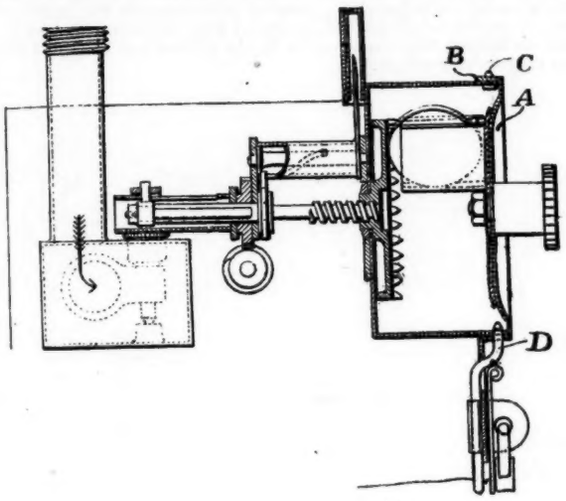
PEEBLES, W. C., of Bonnington.

No. 3568; Jan. 29, 1921.

This invention relates to prepayment meters furnished with a price-changing disc, and in which the mechanism is operated through a rotatable coin-carrier, the insertion of a coin in which locks the carrier to a toothed wheel operating an endwise movable spindle controlling the gas-inlet valve. This spindle is also connected to the measuring mechanism of the meter and to means for moving an indicating pointer over a scale to show the amount of gas prepaid and still unconsumed at any time. The object is to simplify and improve the construction of the price-changing disc and the means for securing it, so that while the mechanism is contained in an attachment outside the meter body with the chamber containing the coin mechanism brought to the front

of the meter (as in certain known forms of such meters) the price-changing disc is so secured in place as to be readily detachable, and thus facilitate adjustment when a change is to be made.

The illustration is a transverse section of the improved meter; but it is to be understood that no claim is made to any feature but the construction of the price-changing disc and the means for locking same.



Peebles' Price-Changing Disc and Lock.

Such construction provides a chamber secured outside the meter body. The front of this chamber faces the front of the meter. The scale which shows the amount of gas in feet which may be allowed per coin is arranged around the edge of a disc A; and according to the invention this disc is made with a flange ring B fitting the circumference of the chamber. In the disc is the usual coin-slot (not shown), and in the ring B are a number of apertures spaced apart similarly to the position of the scale on the price-changing disc A. The position of the disc A (and consequently the number of feet of gas to be allowed per coin) is determined by passing a pin C on the top of the chamber through one or other of these apertures. The combined price-changing disc A and ring B is further held in the position in which it is set by a fork D, the ends of which are entered into two of the apertures in the ring B and into two apertures in the bottom of the chamber. The fork D is prevented from falling free of the apertures by the upper edge of the door of the lower money box; the door being hinged at its lower edge and having a slotted part which passes over a hasp carried by a plate extending across the front of the upper part of the money box. The door is then retained in position by a padlock secured to the hasp. Thus all the mechanism is under official control.

Gas Governor.—No. 179,199.

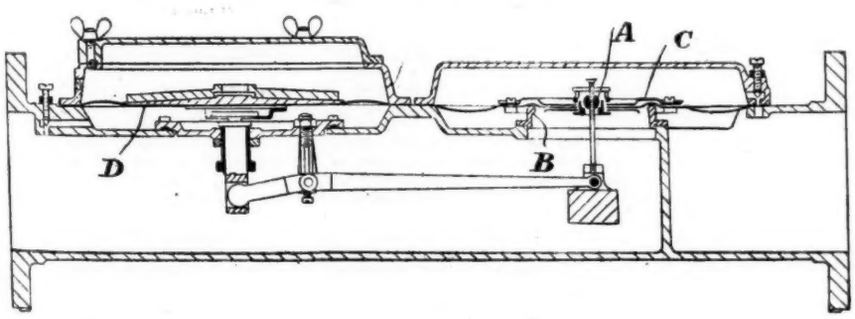
KEITH, G., of Farringdon Avenue, E.C., and the Executors of the late JAMES KEITH, of Farringdon Avenue, E.C.

No. 29,758; July 4, 1921.

This invention relates to an improved gas governor of the type including a loaded diaphragm controlling a relay valve and thereby controlling a gas valve, in which the operation of the relay valve is effected through the intermediary of a lever arranged to magnify the stroke of the diaphragm; the valve arrangement as such being similar to that disclosed in specification No. 120,076. The essential feature of novelty is the interposition of a partition between the loaded diaphragm and the lever, the reduced gas pressure being communicated to the under side of the loaded diaphragm by way of a controllable port.

A vertical section of a governor according to the invention is shown. When the relay valve A, which is preferably a ball valve, is on its seat, the gas pressure from the inlet passes round an annulus B, of which the inner edge serves as a seat for the gas valve C, and finds its way through a passage to the upper side of the gas valve. As the area of the upper side of the latter is larger than that of the lower side by the amount of the valve seat area, the gas valve C is firmly pressed on its seat. If the pressure acting on the loaded diaphragm D falls below that to which it is loaded, the relay valve A will be lifted off its seat, so that part of the pressure on the top of the gas valve C will escape into the low-pressure side of the governor, until the total pressure on the upper side of C is sufficiently lowered to permit the pressure on the annulus to lift the valve C. Conversely, as the pressure rises under the diaphragm D, the relay valve will be closed on its seat, and the gas pressure will begin to rise on the upper side of the gas valve C, thus tending to close the latter until a point of balance is reached. In other words, the gas valve C follows the movement of the relay valve A.

The structure of the governor casting is so designed that the portion carrying the lever fulcrum and the working spindle of the loaded diaphragm may be removed from the top, so that these parts can be conveniently withdrawn from the top in case of necessity and without disconnection from the main.



Keith's Improved Governor.

Mixing Gases.—No. 179,346.

HELPS, G., of Nuneaton.

No. 5573; Feb. 18, 1921.

This invention relates to the enriching or reducing of gas. A main containing say a low-grade gas (or even air to be enriched) is fitted with one or more nozzle connections, containing the gas for enrichment, turned in the direction of the flow of such low-grade gas and acting as injectors to some extent. The injectors are fixed centrally in the gas-main, and may be used singly or in numbers—preferably in conjunction with short pipes or throats to assist injection, which are fixed directly into the main or first into another pipe, which is then fixed into the main in any desired manner.

The action may be described as employing the principles of the bunsen burner to gas mixing, with this difference—that the injector may be fixed with the stream of gas in the main or against it. The main pipe may contain rich gas, or the injectors be connected to less rich gas; or the injectors may be supplied with air. By this means any mixture of gas may be made, and the calorific value of the mixture kept constant.

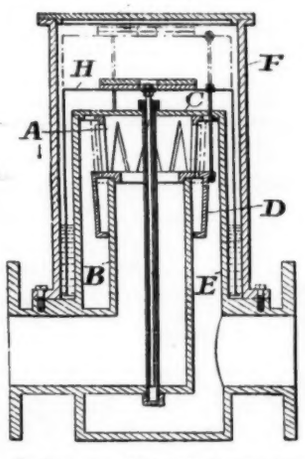
The main at the point at which the high or low grade gas is to be introduced is enlarged so that a short length of pipe of the same diameter as the main, and containing the mixing arrangement, can be inserted. This pipe is provided with a balanced flap-valve at the outlet end; and the small tubes and injectors are fitted at the inlet end. The spindle carrying the valve passes through stuffing-boxes, and has a balance weight attached to it at a convenient point. This valve regulates the flow of the mixture and thus the quality of it. The main in which the gas mixer is fixed is preferably enlarged so that no throttling of its capacity takes place; and provision is made for ready accessibility.

Equilibrium Governors.—No. 179,659.

PARKINSON AND COWAN, W. & B., Ltd., of City Road, E.C., and HURST, P., of Walthamstow.

No. 4768; Feb. 10, 1921.

This invention relates to equilibrium gas-governors of the kind having a single pressure-balanced valve and comprising a fixed annular seating member formed with vertical slots and closed at the top, and a movable annular valve member mounted to slide vertically over the seating member and actuated by a gas bell to open or close the slots more or less according to the position of the bell. The object in view is to provide an improved construction, which is mainly characterized by the fact that the fixed seating member is of conical form and is surrounded by a truncated conical or cylindrical movable valve member arranged to close on seats at the upper and lower ends respectively.



Parkinson and Cowan's Equilibrium Governor.

The illustration is a sectional elevation of a governor constructed according to the invention. As shown, the valve seating A is of truncated conical form very nearly cylindrical, and has vertical slots evenly spaced apart round its periphery. The narrow end of the conical seating is fixed to, or formed integral with, the upwardly directed inner end of an inlet pipe B or a vertical pipe supported on an inlet chamber; while the top or wider end of the conical seating is closed by a hermetically sealed cover or plate C, so that the gas outlet from the seating is through the vertical slots. The valve D, which may be either cylindrical or of truncated conical form as illustrated, is open at

both ends, and is furnished with upper and lower end seats, which engage with corresponding seats on the fixed truncated cone A. The upper seat would in practice be preferably formed of a separate ring or plate screwed-on, to facilitate adjustment. Apart from the end seatings, there is a lateral clearance between the movable and the fixed valve members, preferably tapering to greater clearance at the bottom. As the valve A is open at both ends and is either cylindrical or very nearly so, it is practically pressure-balanced, the value of any unbalanced pressure components being negligible.

The vertical slots in the fixed conical seating are preferably made, in respect to their number and size, of area less than the inlet or outlet area of the governor. In shape the slots taper from a minimum width at the top to a maximum width at the bottom, and the inclined sides of the slots may form parabolic curves in order that the governor may deal with small quantities of gas when the bell is nearly at its highest point, and open gradually for larger quantities. By the passage of gas through the slots and its exit equally in all directions, the gas becomes so divided and quiescent, as it emerges from the valve, that outlet gas can be passed straight up into the bell through the outer portion of the lid C for purpose of control. Thus it is unnecessary to provide the usual communication tube carried from the bell to the outlet pipe, and to seal the suspending rod by a water slide. The valve is suitable for all types of gas-governors, whether for controlling fixed pressure, fixed vacuum, or differential pressure or vacuum. In the construction illustrated, the governor has a main cast-iron body with central inlet chamber surmounted by the truncated cone seating A. An outer cylinder F is flanged upon the body E, leaving an annular space to be filled with water, oil, or mercury, for sealing the bell H.

The inner cover C, which closes the main cast-iron body and cone seating, is held down by a central tube, or hollow rod, which also serves to hold the truncated cone seating, and is fixed by a nut or screw cap to the lower part of the main body.

The valve D, which is preferably of aluminium, is suspended by three rods from the bell H, the rods passing through holes in the inner cover C. The valve D has three lugs at the top grooved and connected with an annular groove (not shown) running round the top face, so that oil, overflowing from an oil seal over the cover, can run down the three rods and flow over the whole of the valve and lubricate both seatings.

The bell H is preferably of aluminium, and has a central rod to act as a guide. Flat lead weights are provided to apply pressure on the bell, and the whole apparatus is designed as compact and low as possible, for placing in an underground pit.

Gas-Heated Portable Wash-Boiler.—No. 179,367.

AIRD, K., and WORTLEY, G. W., both of Falkirk.

No. 7103; Mar. 4, 1921.

According to this invention the patentees construct a gas-heated portable wash-boiler whereby an ordinary standard furnace pan can be used with a casing and clamped to a ring hob positioned on the casing by a series of clamps, the latter adjusting themselves to varying sizes of rims of the furnace pans. The flue outlet, which is in the hob, can with the hob be placed in any position with regard to the casing to suit the desired position of the flue; and the pan can be positioned with regard to the hob and the casing, so that a tapped hole in the pan can be positioned in register with a hole in the casing and a draw-off tap readily affixed. The requisite spacing between the pan and the casing is also ensured. The specification includes fourteen detail drawings.

The patentees claim—

In a gas-heated portable wash-boiler, securing a standard furnace pan to a ring hob having a flue outlet by clamps engaging the rim of the pan; the ring hob engaging the casing and holding the pan in position. The under side of the hob has a series of webs with their edges in the same plane; and a series of clamps having projections for engaging the rim of the pan and the webs is provided, the clamps being screwed to the hob.

Drying Sulphate of Ammonia and Other Salts. No. 179,723.

HANSFORD, J. B., of Bedford.

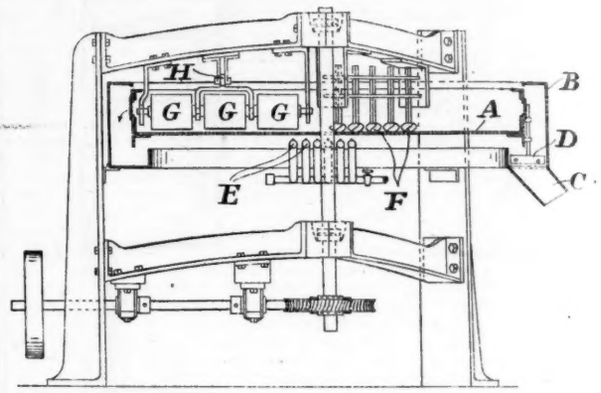
No. 6686; March 1, 1921.

This invention relates to apparatus for drying granular substances of the kind in which the material is placed upon a disc or tray heated from below and rotated about a vertical axis. The apparatus which is the subject of the claim is shown in vertical section; the third frame leg, of course, not appearing in the view.

The apparatus comprises a circular tray A provided with a vertical spindle rotating in ball bearings and carried by frame members, the spindle being driven through suitable gearing from a shaft. Encircling the tray A is a stationary annular receiver B which at one or more points is provided with an outlet C into which the material in the annular trough of the receiver is ejected in the known manner by means of one or more scrapers such as D affixed to the edge of the tray A.

The tray is heated by any suitable means such as a series of gas-burners E underneath the tray and projecting inwardly towards the centre. Depending from two of the upper frame members are two series of ploughs indicated at F, which are adapted to pile up the loose material upon the tray as the latter is rotated; the heaped-up material being spread out again over the tray in a thin layer under the action of centrifugal force after passing the ploughs. This spreading-out and turning-over operation is repeated until the crystals are thoroughly dried. Depending also from another of the upper frame members is a pivoted frame supporting a roller or (as shown) a series of three rollers G adapted to roll on and crush the crystalline material treated in the apparatus when it is spread by centrifugal force in a thin layer over the tray A. The rollers may be loaded to any desired extent, either by hand pressing upon a lever H, or by hanging a weight on the latter and shifting it to any desired position.

In the case of a multiple-stage machine having several trays, the latter are arranged one over the other, and the material to be dried delivered to the top tray in which the first stage of drying is effected. When it is dried to a degree which, at the speed of rotation of the tray, permits it to flow over the edge thereof under the action of centrifugal force, it is deflected by means of plates towards the centre of the tray immediately below for the second stage of drying; and so on until the bottom tray completes the drying process and ejects the salt into the receiving trough.



Hansford's Salt Dryer.

As shown in the drawing, the tray A is provided with a rim of considerable depth around its edge, and this rim with a series of openings covered by coarse wire gauze through which the dried salt is forced by centrifugal action into the annular receiver B enclosing the tray.

Gas Boiling and Grilling.—No. 179,488.

ALLENDER, J. J., and STOVES LIMITED, both of Warrington.

No. 26,989; Oct. 12, 1921.

This invention relates to improvements in devices for use with gas-cookers for enabling boiling and grilling operations to be carried out at will, though with slight alterations the device may be used as a separate unit for carrying out the aforesaid operations. It mainly consists in a burner having a tubular portion in communication with the gas and air supply, a globular portion forming a hollow chamber in communication with the tubular portion (and adapted to co-act with an aperture in a perforated plate to make a comparatively close joint therewith when the burner is used for grilling), and a flame spreader device within the globular portion passing through its open end so as to form an annular passage for the bunsen flame and likewise a continuation of the globular portion of the burner. The complete burner is capable of rotation about its axis to bring it into the boiling and grilling positions as required. Further features comprise bearings in the perforated plate for supporting the burner at each end, and a flange near one end of the burner having flat faces co-acting with the upper surface of the perforated plate to position the burner for the purposes referred to; modified forms of bearings for supporting the burner to co-act with a rectangular projection at one end of the burner for positioning the latter; means for lifting one end of the burner as the latter is being turned round; and the combination, with a burner of the character first referred to and with the perforated plate supporting it, of a second perforated plate attachable to the first.

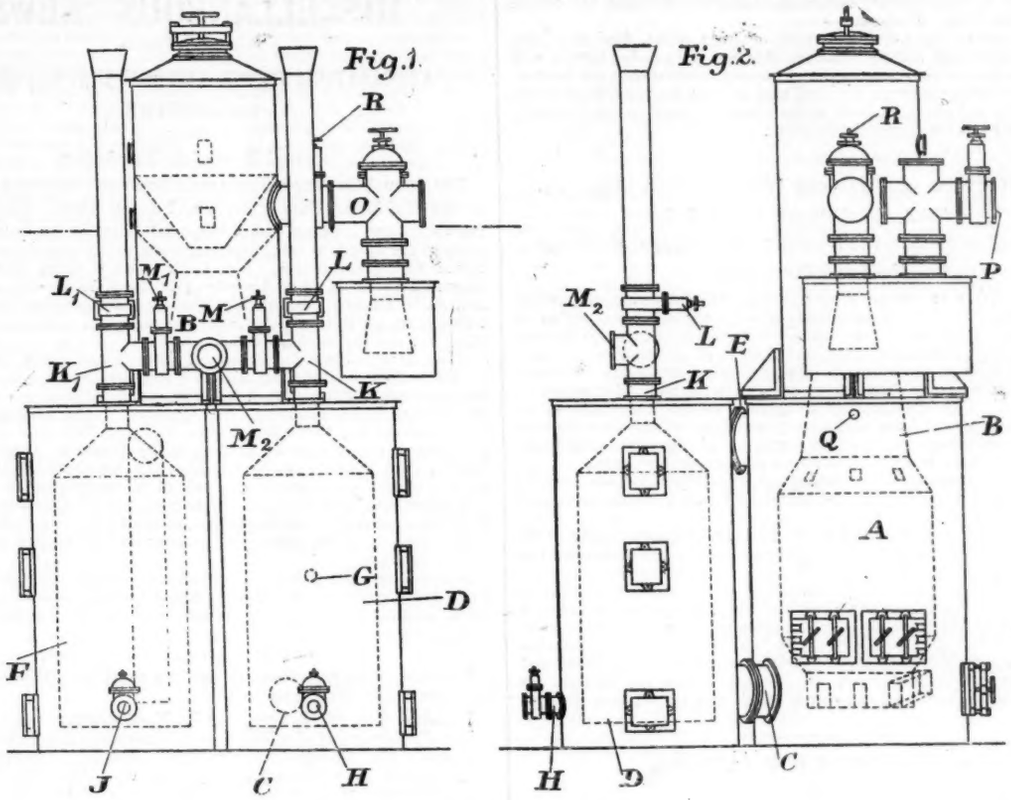
Complete Gasification.—No. 179,643.

SIMPSON, J. F., of Scunthorpe.

No. 4490; Feb. 8, 1921.

This invention relates to apparatus for the complete gasification of carbonaceous fuel, and has for its chief object the reduction as far as possible of the heat losses accompanying this process as usually carried out, and hence an increase in the thermal efficiency. The apparatus may be used either for the manufacture of gas out of a carbonaceous material containing no volatile matter (such as anthracite or coke, by means of the water gas reaction), or out of material containing a considerable amount of volatile matter (such as bituminous coal or gas coal) by means of destructive distillation coupled with the water-gas reaction; the sensible heat carried away by the gases resulting from the latter reaction being used to supply the heat necessary for the distillation.

Figs. 1 and 2 are elevations of apparatus constructed in accordance with this invention. In the example shown, the apparatus comprises a generator A and a superimposed retort B both lined with firebrick. The generator is also connected near the bottom by means of the pipe C with the up blast regenerator D, and, near the top, by means of the pipe E with the down-blast regenerator F. The regenerators and pipes are lined with firebrick, and the regenerators are filled with checker bricks for the purpose of storing heat. Regenerator D is supplied with a steam inlet G, and with a secondary-air inlet H; and regenerator F is supplied with a secondary-air inlet J. Blast pipes K and K_1 are connected to the regenerators, and are fitted with stack valves L and L_1 opening to the atmosphere, and blast valves M and M_1. The blast pipes are connected with a branch pipe M_2 leading to a blast main, which conveys air under pressure from a blower or fan. The generator A is provided with doors, and under certain con-



Simpson's Complete Gasification Plant.

ditions may have no grate bars; the intense heat fusing the clinker and causing it to slag, which slag is tapped through a door.

A coal box or hopper with steam-tight lid is placed on top of the retort B with no intervening coal valve, so that the hopper forms in effect one chamber with the retort. By this means the retort itself may always be kept full of fuel; and, as a consequence, gas-making conditions are maintained uniform, and the incoming solid fuel exerts its maximum cooling effect upon the out-going gas. A gas take-off O is led from the top of the retort to a wash-box, and such take-off is sealed in water of a depth sufficient to prevent passage of the blast up through the retort; or failing a sufficient depth, a valve R may be placed in the take-off. An outlet P conveys the gas to the purification plant. Q is a connection for the admission of liquid fuel to the retort.

The method of operation of the apparatus for fuel containing volatile matter is as follows. This is the more general case; the operation of the apparatus for fuel containing no volatiles being substantially the same, the production of gas merely proceeding without distillation of solid fuel in the retort.

To start-up, a fire is lighted in the generator, and coke or similar fuel is poured on through the lid until it reaches the top of the retort. The coal box is then filled up with coal, and the lid fastened down. The doors are closed, the air valve M opened, stack valve L closed, stack valve L_1 opened, and air valve M_1 closed. The blast from the blower will now pass down through regenerator D, through pipe C, up through the fuel bed in generator A, through the pipe E, and down through continuation thereof to the bottom of regenerator F, up through the latter, and finally escape to the atmosphere by stack valve L_1. The blast will not pass up through the retort B, because of the seal of the take-off O in the wash-box. However, it may in certain circumstances be desirable to allow a small percentage of the blast to pass up through the retort B, in which case a small auxiliary take-off with a seal of less depth could be used, or the same effect could be produced by regulating the valve R (when used).

As the temperature of the fire increases, the checker bricks and lining in regenerator F will absorb heat from the waste gases. Also, as the "blow" continues, the fire will become too hot for complete combustion of the fuel, some carbon monoxide being formed. At this stage secondary air is admitted through connection J to burn this carbon monoxide and so prevent unnecessary loss of heat from the apparatus. Thus the regenerator F obtains its heat in two ways—first from the sensible heat of the whole of the waste gases from the top of generator A, and, secondly, from the latent heat of a part of these gases by means of completing their combustion by the admission of the correct amount of extra air.

When the interior of regenerator F has reached a certain temperature, the blast and stack valves are reversed—*i.e.*, air valve M_1 is opened, stack valve L_1 closed, stack valve L opened, and air valve M closed. The blast will now pass down through regenerator F and up through continuation of pipe E, recovering the heat stored in F by the previous operation. The blast then passes through pipe E, down through regenerator A, and up through regenerator D; heating it in the same way as the regenerator F was previously heated, the secondary air connection H being used when required. When the fuel in generator A has attained a sufficient temperature, the air and stack valves M_1 and L are closed, and steam is admitted at G in regenerator D. The steam passes down through the brickwork, is superheated, and passes by means of pipe C up through the hot fuel bed in generator A, forming water gas. The water gas passes up through the retort B, and, giving up some of its sensible heat, distils-off any volatile matter which may be in the coal coming down continuously from the coal box. The gas then passes off through take-off O, the valve R being previously opened, and through the wash-box to the purifying plant by way of outlet P.

During the run—*i.e.*, that period during which steam is admitted—liquid fuel may be admitted through inlet Q. This will serve a treble purpose—first enriching the gas by the distillation of the hydrocarbons contained in the liquid; secondly, adding fuel to generator A; and, thirdly, partially condensing and cooling the gas coming off at the top of the retort. Also, as the retort is heated internally, and from the base, the passage of the coal downwards through it will keep it cool at the top. This will help to prevent excessive degradation of the more unstable compounds in the gas.

By the construction described, all gases leaving the apparatus are considerably cooled before coming in contact with any of the valves; and the latter are not exposed to any detrimental heat. It has been proposed to arrange apparatus for the manufacture of carburetted water gas, so that an air blast may be caused to blow up or blow down through a generator, the heat being recovered in a heat recuperator or superheater.

Production of Amino-phenols or Aromatic Amino-acids.—No. 179,753.

LEWCOCK, W., ADAM, W. G., SIDERFIN, N. E., all of Beckton, and GALBRAITH, W. L., of Horseferry Road, S.W. 1.

No. 8604; Mar. 19, 1921.

This specification describes improvements in the production of amino-phenols, or aromatic amino-acids, and includes for illustrative purposes (not by way of limitation) examples of the application of the invention. The patentees claim—

1. A process for the manufacture of amino-phenols or aromatic amino-acids, wherein a phenolic or acid azo-compound, nitro-phenol, or nitro aromatic acid is reduced with a sulphide in an alkaline medium, characterized by effecting the reduction with hydrogen sulphide in presence of an alkaline carbonate.

2. A process according to claim 1, wherein the hydrogen sulphide is employed in the form of waste gases containing this sulphide—such, for example, as the gases from ammonia-scrubbers of gas-works.

3. The described process for the manufacture of amino-salicyclic acid.

4. The process described for the manufacture of amino-phenols or aromatic amino-acids.

Gas-Fires.—No. 179,870.

AIRD, K., and WORTLEY, G. W., both of Falkirk.

No. 22,690; Aug. 26, 1921.

This invention consists in detail improvements in various parts of gas-fires; the main object being the supply of a boiling burner and trivet to the fuel plate.

These improvements are described at length in the specification,

which also includes twenty-one detail sketches; but only the claims can be given here. These are—

In gas-fires having a boiling burner under a trivet, dual taps from one gas supply and having separate injectors for gas-fire burner and boiling burner; a ring-plate in the trivet and situated over the burner, and having kettle supports, the dual taps and the boiling burner being secured to a fuel plate; a front to the trivet; a guard to the radiants; and a loose plate for covering the trivet.

Manufacture of Thorium Nitrate.—No. 179,309.

WADE, H., of Hatton Garden, E.C.

A communication from The Lindsay Light Company, of Chicago.

No. 4100; Feb. 3, 1921.

This invention relates to a process for the production of purified thorium nitrate from thorium compounds. It comprises a plurality of steps which are directed to the treatment of naturally occurring thorium-containing compounds for the concentration of the thorium content therein and its final purification. The individual reactions are not a part of the present invention, which consists in the particular sequence of reactions. The specification is applied to the treatment of an Indian monazite sand from which the greater part of the ilmenite content has already been removed by a process of magnetic separation. This product contains approximately 92 p.ct. of monazite sand.

Pressure on these columns prohibits reproduction of the lengthy specification; but the sequence of reactions is stated in the patentee's claim, which is—

A process for the production of purified thorium nitrate from monazite sands, which consists in the sequence of steps of treating the sands with concentrated sulphuric acid to produce an insoluble thorium compound, removing soluble impurities associated therewith, the insoluble thorium compound being directly converted into thorium hydroxide, which is re-dissolved as sulphate and the thorium reprecipitated therefrom as thorium fluoride; the fluoride being extracted with a sodium carbonate solution, whereby its solution is effected and the thorium precipitated from the sodium carbonate solution as hydroxide, subsequently treating with nitric acid to produce thorium nitrate.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for June 8.]

Nos. 14,995 to 15,600.

AURIG, M.—"Apparatus for cleaning, cooling, and mixing gases." No. 15,134.
BARRETT, E.—"Pipe-joints, &c." No. 15,074.
BENGTSON, S. L.—"Mechanical poking-means for gas-producers." No. 15,188.
BRÜCKLMAYR, G.—See Aurig, M. No. 15,134.
COWAN, Sir H.—"Gas-meters." No. 15,456.
COXON, S.—"Indirect lighting." No. 15,114.
DAMIENS, A. A. L. J.—"Extracting sulphur from gases containing sulphuretted hydrogen." No. 15,342.
GIBLIN, J. J.—See Barrett, E. No. 15,074.
HODGSON, J. L.—"Fluid meters." No. 15,139.
HULSEWÉ, A. F.—"Means for reducing speed of flow of gases, &c." No. 15,556.
HUNTER, C.—"Means for controlling supply of steam or air for water-gas generators, &c." No. 15,035.
KEITH, G., and KEITH & BLACKMAN CO., LTD, J.—"Gas-heated water-boiler." No. 15,555.
KENT, W. G.—"Differential pressure recorders." No. 15,203.
LOISY, M. C. J. E. de.—See Damiens, A. A. L. J. No. 15,342.
MATTIESSEN, C. H.—"Slide-valves for gas-engines." No. 15,363.
MOORE, S.—See Hunter, C. No. 15,035.
PARKINSON and W. & B. COWAN, LTD. — See Cowan, Sir H. No. 15,456.
PHILLIPS, T. J.—"Safety gas-cock." No. 15,528.
PIETTE, O. J. G.—See Damiens, A. A. L. J. No. 15,342.
ROSS, P.—See Coxon, S. No. 15,114.
SOULSBY, F. M.—See Coxon, S. No. 15,114.
TRENT PROCESS CORPORATION.—"Process of producing water-gas." No. 15,335.
WHITFIELD, C.—"Gas or oil fired boilers." No. 15,118.
WOODALL, DUCKHAM, & JONES (1920), LTD.—"Annealing wire, &c." No. 15,412.

Silsden Gas Undertaking.

The eighteenth annual report of the gas undertaking of the Silsden District Council, submitted last week, showed a total income of £9674, a decrease of £423 on that of the previous year, yielding a gross profit of £1137, as against £1514. After paying capital charges, &c., there was a net loss of £762 on the year's working; and there had also been capital borrowing during the year, to meet excess expenditure on two schemes over estimates of £1151. The debit balance against the department at the moment is £332. The gas manufactured was 33,888,000 c.ft., an increase of 4,291,000 c.ft.; that sold to private consumers and for public lighting, and used at the works, showing an increase from 27,301,700 c.ft. to 30,825,000 c.ft. The gas accounted for per ton of coal carbonized was 14,887 c.ft., as against 12,070 c.ft. in the previous year; and the gas sold per ton was 13,928 c.ft., as against 11,637 c.ft. The make per ton was 16,367 c.ft. The net income from residuals was £1274, as against £2698. Leakage was 8·9 p.ct., due chiefly to a large escape found near Beck Mill. The year's working expenses decreased by only £46. The report dealt with the difficulties of the coal stoppage period; and the Manager (Mr. Maurice Driver) was complimented on his efficient work during that time.

MISCELLANEOUS NEWS.

ASSOCIATION OF STATUTORY INSPECTORS OF GAS-METERS.

Annual Meeting in Manchester.

The Annual Meeting of this Association was held in the Boardroom of the Gas-Meter Testing Station, London Road, Manchester, on the 1st instant. There was a large attendance; inspectors from all parts of the kingdom being present, along with representatives of their administering authorities. Mr. J. E. Sears (Deputy Warden of the Standards) and his Chief Assistant (Mr. F. S. Read) were also present. Mr. H. N. Barrow, Chairman of the City Justices Gas-Meter Testing Committee, gave the visitors a cordial welcome. Mr. GEORGE HUME (City of London) occupied the chair.

The CHAIRMAN remarked that the Council had given consideration to many details connected with the Regulations of 1920, and recent amendments thereto, which, he said, were more of an explanatory nature than an actual alteration. Members would be doing a service to themselves and to the Association by submitting their difficulties to the Council rather than by writing to the Board of Trade. By submitting such matters to the Council, the members would have the benefit of the considered opinions of a representative number of inspectors who were engaged in carrying out the Gas Measures Acts. The collation and circulation of opinions on all contentious matters would tend to bring about the uniformity in practice that was so rightly desired.

A resolution was adopted, expressing cordial appreciation of the work done by Mr. H. N. Barrow, and thanking him for his efforts to bring together the various authorities and officials interested in gas-meter testing.

ELECTION OF OFFICERS AND COUNCIL.

The voting for the choice of Officers and Council for the current year resulted in the election of:

President: Mr. H. N. Barrow, J.P., Manchester.
Vice-President: Mr. J. Ollis, Chief Officer, London Public Control.
Council: Mr. George Hume (City of London), President; Mr. S. Dyson (Manchester), Vice-President; Mr. W. Templeton (Leeds), Hon. Secretary; Mr. J. L. Barry (L.C.C.), Hon. Treasurer; Mr. S. B. Langlands (Glasgow); Mr. F. Coe (Nottingham); Mr. G. W. Kay (Oldham); Mr. W. Kenyon (Sheffield); and Mr. F. Colburn (Birmingham).

London was chosen as the place for the next annual meeting.

REPORT OF THE COUNCIL.

The Council, in their annual report, stated that they had been in close touch virtually with all questions affecting the Association and their members; including (1) certification of inspectors, (2) amendments to regulations, (3) certificates for over-rated meters, (4) uncertificated persons as inspectors of gas-meters, and (5) uniform types of certificates. With regard to the certification of inspectors, the case for the inspectors had been submitted to the Board of Trade, who, in reply, pointed out that inspectors were not subject to examination, that no certificates could be granted without examination, and that there could not be two standards of examination. The Council were, therefore, obliged to give up the idea of fulfilling the wishes, expressed at the last annual meeting, to obtain such certificates. Regarding amendments to Regulations of 1920, the Council were of opinion that the amendments were both reasonable and practicable. During the year there had been one resignation from the Association, and two new members had been added; so that there were now 37 members on the roll and 3 associate members.

GAS-METER TESTING.

The afternoon session, when the new President was in the chair, was taken up with the consideration of a paper on "The Past and Present of Gas-Meter Testing," read by Mr. F. COE, of Nottingham.

The author said the first purpose of his paper was to ascertain as far as possible, by discussion, to what extent the Acts relating to the sale of gas and the testing and stamping of meters were superseded by the Gas-Meter Regulations, 1920, and subsequent Board of Trade memoranda. Secondly, to consider the advisability or otherwise of giving fuller consideration to the capabilities of meters by means not stipulated, as far as might be already authorized; and, finally, to co-ordinate opinion as to the exhaustive nature of the stipulated tests. Mr. Coe brought out these points very fully and frankly.

A general discussion followed, and a wish was expressed that the Executive should consider the desirability of framing a set of rules for the guidance of gas-meter inspectors with a view to securing uniformity in methods of inspection.

MAYORAL HOSPITALITY.

The Lord Mayor of Manchester (Mr. E. D. Simon) entertained at luncheon, in his rooms at the Town Hall, the Executive of the Association and members and chief officials of the City Justices' Gas-Meter Testing Committee (Mr. H. N. Barrow, Chairman, Mr. Harold King, Deputy Chairman, Mr. R. E. Boardman, Mr. H. Boddington, Mr. W. H. Hesketh, Mr. Charles Kean, and Mr. Hans Renold), Mr. T. B. Wilby (Justices' Clerk), Mr. Robert Bell (Deputy Clerk), Mr. S. Dyson (Inspector), and Mr. H. Gollings (Assistant Inspector). It may here be remarked that the gas-meter testing station in Manchester is admittedly in the front rank of such stations in its spaciousness and equipment. Fifty thousand meters were examined and stamped at the station last year.

The LORD MAYOR spoke of the importance of the gas industry. It was obvious, he said, from the blackened condition of buildings in Manchester, that much yet remained to be done before air pollution by smoke was ended. He thought the Smoke Abatement Committee, of which he is the Chairman, had done something in this direction; but

the Gas Committee had done much more. Yet at a meeting that very day of the Sanitary Association, Prof. Armstrong made what seemed to him a very furious onslaught on gas. Prof. Armstrong was interested in solid smokeless fuel. The making of such fuel was in the experimental stage; but the Professor was satisfied that in a short time this sort of fuel would be on the market in very large quantities. He hoped that Prof. Armstrong's belief would be realized. But if it were realized, it did not mean that gas would be abolished. Gas would still be needed for heating and cooking. He was glad that so much provision was made in the new houses which the Manchester Corporation had built, or were building, for heating and cooking by gas, for until the smokeless fuel came along the only way to fight the smoke nuisance was by increasing the use of gas.

Mr. PETERSON, Senior Magistrate of Glasgow, spoke of the similarity seen in the methods by which the Corporations of Glasgow and Manchester sought to deal with the problems before them.

Mr. MADELEY, J.P. (Birmingham), complimented Manchester on possessing such a fine and well-equipped meter-testing station. Manchester had led the way in this particular question; and the manner in which Mr. Barrow and the Testing Committee had done their work had made it a pleasure to other authorities to co-operate with them in all matters pertaining to the testing of gas-meters.

Mr. BARROW, in proposing thanks to the Lord Mayor, emphasized the importance of seeing that gas consumers were supplied with accurate meters.

Mr. CUNDIFF (Deputy Chairman of the Manchester Gas Committee), seconding Mr. Barrow's proposition, pointed to the measures now being provided at the chief gas-works of Manchester for an enlarged gas supply. He also hinted that although the Gas Committee had just reduced the price of gas 4d. per 1000 c.ft., it might be that in the autumn of the present year there would be a further reduction.

Mr. J. E. SEARS (Deputy Warden of the Standards) and Mr. GEORGE HUME (London) also spoke in support of the motion. Mr. Sears eulogized the work done by Mr. Barrow and his colleagues, and the Committee's Chief Inspector (Mr. Dyson).

After a short reply from the LORD MAYOR, the company separated.

GAS REGULATIONS ACT APPLICATION.

The following further notice has appeared in the "London Gazette" regarding an application to the Board of Trade for an Order under the Gas Regulations Act.

Tadcaster and Wetherby District Gas Light Company, Ltd.

The standard price now authorized in respect of the supply of gas by the undertakers is 5s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 8d. per therm.

SPECIAL ORDER.

Atherton Urban District Council.

The Council are applying for a Special Order under section 10 to empower them to hold on lease and use for gas-works purposes a scheduled piece of land.

DECLARATIONS OF CALORIFIC POWER.

Brading Harbour District Gas Company.—450 B.Th.U. (July 1.)
Dowlais Gas and Coke Company.—500 B.Th.U. (June 2.)
East Grinstead Gas and Water Company.—440 B.Th.U. (June 30.)
Tynemouth Gas Company.—470 B.Th.U. (June 15.)

GAS REGULATIONS ACT ORDERS.

We have received from the Director of Gas Administration copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulations Act.

Cranleigh Gas and Coke Company, Ltd.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 18·6d. per therm; and this price shall be substituted for the price of 5s. 6d. per 1000 c.ft. wherever it occurs in sub-section (2) of section 17 (price of gas) of the Cranleigh Gas Order, 1910.

After the declared date, "therm" shall be substituted for "1000 c.ft.," and the words "fifth of a penny" for the word "penny" wherever it occurs in paragraph (2) of Schedule B to the Cranleigh Gas Order, 1910.

Prepayment meter clauses are included. (June 9.)

Elstree and Boreham Wood Gas Company, Ltd.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 16d. per therm.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-a-half. (June 7.)

Littleborough Gas Company.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 16d. per therm. (June 7.)

Milnrow Gas Company.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 16d. per therm. (June 2.)

Witney Gas and Coke Company, Ltd.

After the declared date, the maximum prices in respect of gas supplied by the undertakers shall be 16·6d. and 19d. per therm; and these prices respectively shall be substituted for the prices of 5s. and 6s. per 1000 c.ft. wherever they occur in section 25 (price of gas) of the Witney and District Gas Order, 1911.

After the declared date, "therm" shall be substituted for "1000 c.ft.," and the words "fifth of a penny" for the word "penny" wherever they occur in paragraph (ii) of Schedule B to the Witney and District Gas Order, 1911. (June 6.)

NOTTINGHAM GAS UNDERTAKING.

Profit of £115,019.

It is to the great satisfaction of Nottingham ratepayers that recurring annual reports relative to the gas undertaking continue to show substantial profits, permitting of the allocation of large sums in relief of municipal burdens. This year the record is again of the customary gratifying character, allowing of £30,000 being voted in reduction of rates out of a net profit amounting to £115,019. The deficit on the year's working of the electricity undertaking totalled £9069.

The annual report for the period to March 31 last, which has just been issued, together with the accounts, by the Gas Committee (of which Mr. Alderman Albert Ball is Chairman), explains that the income for the year upon the revenue account amounted to £780,024, and the expenditure to £665,004, leaving a balance of £115,019 to be carried to the profit and loss account. To this is added £6377, representing interest on investments, together with £36,697 brought forward from last year. After charging interest on capital, the annual contributions to the sinking funds, £5000 for depreciation of stoves and £5000 for depreciation of meters, there remained an available balance of £79,873. The Council having decided to take £30,000 as a contribution in aid of the general district rate, the Committee recommend that £10,000 be transferred to the renewals account, and that, in view of the continued heavy cost of maintenance work, &c., the balance of £39,873 be carried forward.

The quantity of gas sold during the year was 2,375,075,700 c.ft., against 2,273,970,400 c.ft. the previous year; being an increase of 101,105,300 c.ft., and an increase of 123,773,000 c.ft. as compared with the year ended March 31, 1914. The popularity of prepayment meters still continues, and the sale of gas through these meters during the past year showed an increase of 66,525,600 c.ft. The amount of gas sold per ton of coal carbonized was 12,917 c.ft., as against 13,463 c.ft. last year. This decrease, the Committee observe, is due entirely to two factors—inferior coal, and the output of a better quality of gas during the latter portion of the year. The gas sold for public lighting was 86,420,300 c.ft., as compared with 64,345,100 c.ft. for the previous year and 102,143,500 c.ft. for the year ended March 31, 1914. No change in the scale of charges for gas has taken place during the year; but the Committee have now decided to recommend a reduction of 6d. per 1000 c.ft. in the charges for gas supplied through ordinary meters, and a rebate of 1d. in the shilling on gas supplied through prepayment meters; such reductions to come into operation from the date of the reading of ordinary meters for the Midsummer quarter, and the collection from prepayment meters as and from July 1. Good progress has been made with general repair and maintenance work; but the average prices payable throughout the year for materials and labour have still been abnormally high. The effect of high prices for coal, materials, and labour is again clearly demonstrated by comparing the figures for gas sold and total expenditure for the past year with the corresponding figures for the year ended March 31, 1914, as follows:

Year ended	Gas Sold.	Total Expenditure.
	Cubic Feet.	£
March 31, 1922	2,375,075,700	665,005
March 31, 1914	2,251,302,700	250,995
Increase . . .	123,773,000	414,010

The expenditure per million cubic feet of gas sold has therefore increased from £111 9s. 9d. for the year ended March 31, 1914, to £279 19s. 10d. for the year ended March 31 last—an increase of 151 p.ct. The Committee added that considerable reductions in labour charges had recently come into operation; and seeing that a substantial reduction in the price of coal was also anticipated, the expenditure figures for next year should show a considerable decrease. At the present time the markets for coke and tar products were very depressed, and the receipts from these sources during the next year were bound to be considerably lower. The outstanding matters in connection with the Ministry of Munitions tenancy of the Radford Gas-Works had now been settled on satisfactory terms; and the vertical retorts were reconstructed during the course of last summer. These retorts are now at work again, and giving excellent results. It was anticipated that the contracts which the Committee had placed for the provision of increased washing plant at Radford, and the reconstruction of the Glover tower at the Giltbrook Chemical Works, would be completed within the next few months.

MR. JOHN WILKINSON'S REPORT.

Supplementing the Committee's statement, much valuable information is embodied in the eleventh annual report which is attached to it of the Engineer and General Manager (Mr. John Wilkinson), who explains that during the period under review 170,774 tons of coal and 305,959 gallons of oil were utilized in the course of manufacturing the following products: Coal gas, 2,271,729,000 c.ft.; water gas, 174,185,000 c.ft.; total, 2,445,914,000 c.ft. (the water gas equalling 7·12 p.ct. of the total gas made); coke (for sale), 82,895 tons; tar, 8623 tons; ammoniacal liquor (10-oz. strength), 23,276 tons. Mr. Wilkinson observes that the British Sulphate of Ammonia Federation are introducing conditions into their contracts for the purchase of sulphate of ammonia which will render it necessary for the Committee to undertake the erection of new plant to produce neutral and moisture-free sulphate; and particulars of such plant will be placed before the Committee in due course.

The following are the details of the sale of gas during the year: Ordinary consumers, 1,228,941,400 c.ft.; prepayment consumers, 800,853,400 c.ft.; power consumers, 249,900,200 c.ft.; gassing consumers, 8,960,400 c.ft.; public lamps, 86,420,300 c.ft.; total, 2,375,075,700 c.ft. These figures indicate an increase of 101,105,300 c.ft., or 4·45 p.ct., when compared with the sale of gas (2,273,970,400 c.ft.) for the previous year. The following are the comparative

receipts for gas sold: Year ended March 31, 1922, £551,242; year ended March 31, 1921, £521,004; increase, £30,238. The gas unaccounted for during the year was 70,838,300 c.ft., or 2·89 p.ct., as compared with 57,075,600 c.ft., or 2·45 p.ct., for the previous year. The sale of gas per ton of coal carbonized was 12,917 c.ft., as compared with 13,463 c.ft. for the previous year. The total length of mains laid at March 31 was 422·07 miles. There were 1758 new gas services connected to the mains, against 841 in the previous year. The number of meters fixed to March 31 (including 440 lamp meters) was 88,430; being an increase of 1700 meters on the previous year. Of these, 86,280 are owned by the Gas Department and 2150 by consumers. The average consumption per meter (exclusive of lamp meters) equalled 25,744 c.ft., as compared with 25,304 c.ft. in the previous year. The position of gas in regard to its application for trade and domestic purposes, other than lighting, has been maintained, and on March 31 there were in use: Gas cooking-stoves (about), 38,782; gas-fires (about), 21,357; gas-engines (about), 935. Of the 38,782 cookers fixed, 10,982 were rented from the Department and 26,268 supplied rent free with the automatic meters. There is also in use a large number of other appliances of various descriptions which have not been summarized. The number of public lamps erected within the area of supply at March 31 was 8229—viz., 5565 in the city, and 2664 in the country districts. The lighting of the public lamps within the boundaries of the City was again suspended for a period of fourteen weeks during the summer season. The following are the comparative expenditures for coal and income from residuals during the last three years:

—	Expenditure for Coal.	Net Income from Residuals.
	£	£
Year ended March 31, 1922	336,763	200,591
,, ,, March 31, 1921	310,748	224,651
,, ,, March 31, 1920	214,648	165,393

BARROW GAS-WORKS REPORT.

At the monthly meeting of the Barrow Town Council, on May 29, Alderman A. Brown (the Chairman of the Gas and Water Committee) gave a report upon the working of the gas and water undertakings for the past year.

He said they had sold 351 million c.ft. of gas during the year, a decrease of approximately 4 millions on the preceding year, or about 1 p.ct. of the make. The decreased consumption was accounted for in the supplies to trading customers. The domestic consumption was on the increase. The large increase in the manufacture of carburetted water gas for the year was due to the coal dispute. The supply of this gas averaged 8·3 p.ct. The department during the dispute was compelled, in order to keep the supply going, to purchase coal and oil of any quality, and from any source, and at high prices; the result being a serious falling-off in bye-products, and a financial loss of over £3500. Accelerated collection from the prepayment meters had rather more than covered this estimated loss for the year.

Receipts from gas sold had for the first time in the history of the undertaking exceeded the sum of £100,000, and were £7000 more than for the previous year. Owing to the serious slump in the prices of residuals—particularly tar and sulphate of ammonia—sales of these commodities had realized £11,600 less. It had been possible to effect savings in the coal bill, repairs, taxes, and establishment charges amounting to £8600. On the other hand, the cost of manufacture and distribution had increased by £5500. During the year wages of shift workers had decreased by 14 p.ct., and of labourers by 16 p.ct. In addition to meeting statutory sinking fund instalments, they had followed their usual practice of earmarking a specified sum for renewing works and plant; and £8400 had been set aside for this purpose. The expenditure during the year against the renewals fund was £13,700. Improvements and extensions had been introduced ensuring an improved gas supply and an increase of bye-products. The extensions included new purifiers, repair shop, and weigh office and store, at an approximate cost of £5000. The net profit, after making provision for meeting all liabilities, was £3625.

The recent reduction of 9d. per 1000 c.ft., which came into effect April 1 last, represented a concession to the consumers of £13,000 per annum on the present rate of consumption. This amount, less the profit announced—*i.e.*, £10,000—must be made-up by reductions in working expenses and economies during the current year. Therefore, at the present time, while the Committee were anxious to give the consumer every consideration, he could not hold out any immediate prospect of a further reduction in price. The net profit of £3625 represented only 1⅛ p.ct. on the capital expended on the gas undertaking.

The report was approved without comment.

Buckhaven Provisional Order.—The Buckhaven and Leven Town Councils are to be opposed by the Fife County Council in their application for a Provisional Order in connection with the gas-works. The County Council desire various clauses inserted; one being that the Local Authority outside the burgh, and served by the burgh gas supply, should acquire that section of the undertaking in their area.

Derby Corporation and Gas Prices.—The Special Purposes Committee of the Derby Town Council have approved the following recommendations regarding gas supplied to the Corporation by the Derby Gas Company: (*a*) The price at any time not to exceed 7½d. per therm; and the price to be charged to the Corporation for gas for any lighting purposes not to exceed the lowest price charged for the time being by the Company to any person for lighting; (*b*) the price in any one year to be at the net cost per therm of the manufacture of gas and working expenses, *plus* 1d. per therm.

CHARGE FOR POWER PURPOSES AT STOCKTON.

A long discussion took place at last Friday's meeting of the Stockton-on-Tees Town Council, relative to the Gas Committee's report that they were satisfied that the charge made for gas for power purposes was an economic figure.

Mr. KELSALL asked the reason that prompted the Committee to make such a statement, and what was the present cost per 1000 c.ft. of the production of gas for power, after allowing for all credits.

Mr. WILKINSON, in reply, said the first part of the question had been answered previously; and he was not able to reply to the second part at such short notice.

Mr. KELSALL thereupon moved as an amendment that the word "not" should be inserted in the Committee's minute, thus making it read that the Committee were satisfied that the charge was not an economic figure. He stated that power consumers were paying 3s. 6d., 3s. 5d., 3s. 4d., and as low as 3s. 3d. per 1000 c.ft. for gas, while the net cost of the gas was 3s. 11·28d. per 1000 c.ft. For the year 1920-21, of the total amount of gas consumed, only one-tenth was absorbed by power users, who took gas for 2½ hours out of the 24. There were only 112 power consumers in the borough; but there were 4823 gas-cookers. There were also 4332 boiling-rings. Yet these people were paying a full rate of 4s. 4d., less 10 p.ct., with ordinary meters; while if they had slot-meters, they did not know what they paid. The Corporation had lost £530 in the year in supplying gas for power.

Mr. WILKINSON observed that Mr. Kelsall was altogether wrong in stating that the more gas power consumers took the more the Committee lost. If they had more power consumers at the present price, they would be able to reduce the charge to the lighting customers. They could not do without the power users; and they must maintain the price at a figure which enabled those consumers to take it.

Mr. GARGETT stated that the figures given by Mr. Kelsall made a great impression on the Gas Committee; but they were replied to by the Chairman, who stated that the cost of the production of gas to the power consumers was something like 1s. 0½d. per 1000 c.ft. less than to other consumers.

The amendment was lost by 10 to 20 votes; but a further amendment that the matter be referred back was carried by 20 to 9 votes.

TRADE NOTES.

Turbine Furnaces.

The Turbine Furnace Company, Ltd., of Gray's Inn Road, W.C., have secured orders, during the last two months, for the installation of their patent turbine furnace covering, among others, the following industries: Engineering, railways, transport, shipping, colliery, metal, chemical, gas, municipal (baths and bakeries), milling (flour and paper), brewery, laundry. Many of the orders are repeat ones, and are drawn from the British Isles, Egypt, and the Overseas Dominions. Over fifteen hundred furnaces are now installed in the British Isles alone; and a very substantial business is, we are informed, being done in Continental Europe and her Colonies and in the British Overseas Dominions, &c.

"Radmolite."

This is a refractory material which may interest our gas-fire makers. Refractories of various kinds have been produced for supporting the heating elements for electric-fires; and "Radmolite" is the name given to a material which the Moler Fireproof Brick and Partition Company, Ltd., have now available for the electric market. We are informed that the material offers marked advantages over ordinary fireclay and steatite formers for heating elements. It is largely composed of diatomaceous earth; and it is remarkably efficient as a thermal insulator. When made-up into a firebar, it absorbs heat at such a low rate that the element springs into life almost as soon as it is switched-on. With fires which rely on a high-temperature element for their popularity, this feature is of immense importance. It means that the heat rays are immediately reflected forward. With ordinary fireclay, a considerable time elapses before the element attains its maximum temperature, because the fireclay itself, by comparison with "Radmolite," absorbs heat at a much higher rate. It also scores heavily over fireclay in the matter of weight, being at least half that of any firebar of similar volume. Messrs. Lionel Robinson & Co. (the partners being Mr. Lionel Robinson and Mr. W. E. Warrilow), of No. 3, Staple Inn, W.C., have been appointed selling agents for the southern district.

Cheaper Gas at Uddingston.—The price of gas in the Bothwell and Uddingston district has now been reduced to 2s. 10d. per 1000 c.ft.; and there is likely to be a further reduction in the course of a few months. The charge previously was 3s. 4d.

Unpaid Bills at St. Ives (Cornwall).—Bills unpaid for years were mentioned at a meeting of St. Ives (Cornwall) Town Council—the Mayor (Mr. W. Pearce) presiding—when Mr. R. Toy, Jun., asked if there was a report from the Sub-Committee appointed to go into the gas accounts. Mr. S. C. Beckerley (a member of the Sub-Committee) said there was no formal report; but the examination of the coke and tar account gave evidence that discounts had been granted where payments had been delayed considerably beyond the limit of one month allowed. On the other hand, some with regular and fairly large accounts received no discounts. A "balances" statement for residuals for the year to March 31, 1921, was not on record in the books for the audit; and there were delays in making ledger entries. In connection with the residuals and fittings accounts, there were bills outstanding for years against reputable people, by whom, it was thought, payment would be made if accounts were rendered. These and other matters called for serious consideration. It was decided to convene a meeting of the Gas and Water Committee to examine the books of the two departments.

TAXING IMPORTED GAS-MANTLES.

The Committee appointed by the Board of Trade under Part II. of the Safeguarding of Industries Act, to consider a complaint with regard to gas-mantles imported from Germany, held their first sitting on Thursday last. The Chairman of the Committee is Sir Bernard Mallet, K.C.B.; the other members being Mr. J. Arthur Aiton, C.B.E., Sir John N. Barran, Bart., Mr. G. A. Moore, and Mr. Arthur Pugh. The complaint is that mantles for incandescent lighting manufactured in Germany are being sold or offered for sale in the United Kingdom at prices which, by reason of the depreciation in the value in relation to sterling of German currency, are below the prices at which similar goods can be profitably manufactured in the United Kingdom, and that by reason thereof employment in the incandescent mantle industry in this country is being, or is likely to be, seriously affected. The Committee are directed, after ascertaining the facts, to report to the Board of Trade (*a*) whether the conditions specified in section 2, subsection (1) of the Safeguarding of Industries Act, 1921, are likely to be fulfilled; (*b*) on the effect which the imposition of a duty under Part II. of the Act on goods of the class or description covered by the complaint would exert on employment in any other industry, being an industry using goods of that class or description as material; and (*c*) whether in the opinion of the Committee production in the industry manufacturing similar goods in the United Kingdom is being carried on with reasonable efficiency and economy.

The complainants are the Incandescent Gas-Mantle Manufacturers' Association, who are not represented by Counsel. The opponents are a number of importers (represented by Mr. KENNETH SWAN), and the National Gas Council (represented by Mr. OGILVIE, Joint General Manager).

The case for the complainants was presented by Mr. J. P. H. SOPER, Managing Director of Monarch Mantles, Ltd., proprietors of the Plaissetty Manufacturing Company, who said a rumour had reached him that the German Convention of Gas Mantle Manufacturers were opposing; and he asked for it to be made clear who were the opponents.

Mr. SWAN said he appeared for certain importers. So far as the German Convention was concerned, they desired to be heard at the next meeting of the Committee.

Mr. SOPER stated that the gas-mantle to-day was of very great importance because of the new standard upon which gas was supplied. It was essential that the gas-mantle industry should receive assistance to carry it through the present abnormal state of affairs, so that it might be maintained when things became once more normal. Mr. Soper then described the method of the manufacture of gas-mantles, and related how, before the war, the Germans had control of the monazite sand deposits at Travancore in India and of practically the whole of the asbestos. Now, however, everything required for the manufacture of mantles could be made in this country; and the raw materials were available to British makers instead of being controlled by the Germans. Thus the country was now self-supporting, not only for the finished product, but also for the raw materials. Coming to German prices, it was pointed out that these were controlled by the Convention of German manufacturers, of which all the manufacturers in Germany were members. This organization fixed the prices under three heads—viz., an internal selling price in Germany; prices for export to tariff countries; and prices for export to Great Britain, the latter being higher than the prices to tariff countries. The British Association attached considerable importance to this range of prices, because there appeared plenty of margin between the cost of manufacture in Germany and the selling price to this country to enable the Germans to adjust their prices to meet any tariff the Committee might recommend. This was shown by the fact that in the case of tariff countries in other parts of the world the price was lowered by the amount of the tariff. One of the most important phases of the inquiry would be the cost of production in this country. The Committee would have evidence that two of the factories in this country were controlled by Germans before the war. One, in fact, was directed by one of the leading Continental manufacturers. These factories were worked on Continental lines; and the same methods held to-day in these factories, which were in British hands. As a matter of fact, there was no appreciable difference between methods of manufacture now in this country and in Germany, so that it could not be said that we were not manufacturing efficiently and economically. Figures of British costs of production would be given to the Committee confidentially. He would, however, say this much at the moment. They had taken out, on the method of costing which was left as a legacy in one of these German factories, the cost at which mantles could now be produced if British makers were working under German conditions—*i.e.*, if we were buying materials at the prices at which the Germans were able to buy, and paying the same rates of wages as the Germans were paying, and if we were subject to what were believed to be the German overhead charges. Under these conditions, taking the mark at 1200, the cost of manufacture would be 1100 marks, or something under £1 a gross. If he satisfied the Committee that under German conditions mantles could be manufactured at the price he had mentioned, then he claimed he would have substantiated two of the main points—viz., that British methods of manufacture were efficient and economical; and that the difficulties which the British manufacturer had to face now in meeting German competition were due to the depreciation in currency, and to that alone.

Mr. SOPER then gave formal evidence in favour of the complaint. He said that the Incandescent Mantle Manufacturers' Association consisted of the principal manufacturers in this country; and the members collectively produced in their factories about 95 p.ct. of the mantles manufactured here. The total capital employed by the members was about 1½ millions sterling, part of which represented extensions made at war costs to satisfy the country's demands for mantles during the war. In addition, the members had invested some £350,000 in subsidiary industries. Referring to the manner in which the Germans before the war had secured a monopoly in the supply of thorium and cerium, ramie yarn, asbestos, and magnesia rings, Mr. Soper said that in the early part of 1914 a move was made by the German manufacturers of thorium and mantles to establish an international convention regulating the supply and prices of gas-mantles. The British manufacturers were summoned to a meeting at which a scheme was placed before them based on the following principles: (*a*) The production of each factory (here and abroad) was to be limited to the number produced in the preceding year; (*b*) any factory making and selling more than its fixed production would be fined, and a substantial part of the profits would have to be paid into the pool; (*c*) the selling prices in each country would be fixed by the Convention and controlled in Berlin; (*d*) all disputes and questions would have to be settled in Berlin according to German law. Similar meetings were held in other countries; and it was intimated that any firm not agreeing to the scheme could no longer rely upon a supply of thorium nitrate, which would have been tantamount to closing it down. The war put a stop to the development of the scheme. At the present time the whole of the material required for the production of gas-mantles in this country could be obtained in England. After the Sankey judgment, mantles began to come into this country in quantities, and the imports from Germany increased very largely. Throughout 1921 importers were able, and were still able, to buy mantles from that country at prices much below the then and the present British costs of production, due to the depreciation in currency and to no other cause. The figures of importation from Germany were:

—	Quantity.	Value.	Average Price.
		£	s. d.
1920	21,359 gross	51,710	48 5
1921	63,756 ,,	111,917	35 1
1922 (first quarter) .	36,153 ,,	55,707	30 9

It was believed that the German prices for this country were fixed so as to fall below, but not very much, current British prices, and possibly with a view to meeting any action which might be taken by British manufacturers under Part II. of the Act. The falling-off in orders which had been experienced by the British manufacturers was due to price and nothing else, and had resulted in progressive unemployment in the industry. As to the efforts made to keep the trade going, it was pointed out that last season a special mantle, under a label and in a box common to all members of the Association, was put on the market at a price below the costs of production; the price being reduced to 5½d. For next season, trade prices of British mantles had been substantially reduced all round, and a rebate scheme was being offered to all members of the trade who would only stock and sell British-made mantles. The scheme, however, would result in a loss unless increased turnover resulted.

Answering the Chairman on the point that the reduced output and lesser employment might be due to trade depression as well as German competition, Mr. Soper said that trade depression did not affect the mantle trade considerably. Moreover, as between 1920 and 1921 there had been an increase of 30,000 in public gas-lamps.

The CHAIRMAN: I cannot believe that the present trade depression has not affected the industry.

Sir JOHN BARRAN said the real question to be determined was the question of price; and for that purpose the Committee must have as full and clear information as possible as to the comparative prices of both British and German mantles in 1913 and at the present time. On the question of monazite sand, Sir John asked whether there was any means of reducing that on the spot in India, to save the heavy cost of freight, and so bring down the ultimate cost.

Mr. *C. S. Garland* (Managing Director of Lighting Trades, Ltd.), explained that sulphuric acid was the chief material used in the manufacture of thorium and monazite sand. There was no plant in India for the purpose, on the one hand, and on the other it would require the transport of 2·6 tons of sulphuric acid to India for every ton of sand treated.

Mr. SOPER, answering Sir JOHN BARRAN, declared he should not expect the price of the mantle to go down because a tax was put on. What would happen was that the tax would go into the pocket of the British Treasury, being paid by the Germans. The effect, however, would be a fairer competition, although a tax would not eliminate competition by any means. The Referee during the course of the hearing indicated one method of taxation—viz., in the case of the inverted mantle, the value deducting the ring; and in the case of the upright mantle, the value less the asbestos. If that were adopted, a duty under Part II. would be on some substance representing perhaps 30 p.ct. of the value of the mantle. If, on the other hand, the duty was imposed on what was called (for short) the ash value of the mantle—*i.e.*, the value of the thorium and cerium as ash, and not as a mantle—then the duty would be very much smaller. On the lower interpretation it would be on about 3 p.ct.

Answering Mr. AITON, Mr. Soper stated that his Association did not regulate prices; but it was only right that he should intimate that some of the members of it had a price maintenance agreement among themselves. These, however, were only a proportion of the members. There were some members of the Association who were outside that agreement. The larger firms were inside the agreement.

Mr. AITON suggested that it was German competition that had brought the price down.

Mr. SOPER said it could be put in that way; but the manufacturers could not be accused of unreasonably keeping their prices up if they compared the increased prices with the increase in the cost of raw materials and labour.

Answering Mr. MOORE, Mr. Soper pointed out that if the decision of Mr. Atkinson was held to apply to the burned-out mantle, the duty chargeable would not be sufficient to enable the industry to go on.

Mr. *C. S. Garland* said the principal raw materials in mantle manufacture were decorticated grass and monazite sand, costing 2s. 7d. approximately per gross in the total. Another commodity essential to the mantle industry was coal gas; from 1 to 1·6 c.ft. being used in the manufacture of each mantle. If all the mantles required in this country were made here, it would mean a consumption of 60 to 70 million c.ft. of gas per annum. The pre-war price of gas in Wandsworth (where most of the English incandescent mantle factories were

situated) was 1s. 6d. per 1000; but to-day it was equivalent to 4s. 7d. The last official figures for gas in Germany (March) were the equivalent of 1s. 8d. per 1000 c.ft., taking the mark at 1200 to the £. The plant used in German factories was substantially the same as that used in British factories. The upright knitting machine was German; but the inverted knitting machine was British. Generally speaking, manufacture had become so standardized that it was difficult to pick out one point in which either country was better than the other. He had personal knowledge of the four British thorium factories. Their capacity was equal to the country's total requirements, including a liberal estimate for export trade. One of them was a very large factory erected under the auspices of the Travancore Minerals Company; but it had never been put into operation, because at the time it was in a position to make thorium nitrate the demand for it fell off in consequence of the German importation. Of the remaining four, three were completely closed, and the other one was working half-time. One of the factories (at Ilford) could produce nitrate of thorium cheaper than any factory in the world on equal terms; but it could not produce cheaper than Germany to-day, because of the large pre-war stocks held in that country. These works had a stock of some 7000 to 10,000 kilos. There were two English ramie factories, but both were on half-time. There were three ring factories. Two of them were completely closed; while the third was producing one-third of its normal output. His Company was interested in one of the ramie factories, and also to a small extent in one of the ring factories, which latter during the war not only supplied this country, but Belgium, France, and America. He was told that there were over 100 German mantle factories now as against 150 before the war; and the Auer Company claimed to make 99 million mantles a year. On the question of the job mantle, they were really a fraud, and an endeavour to evade the Convention price. There had been one offer to send mantles to Hamburg at 15s. per gross wholesale, ostensibly for the American market, but delivery could have been had in this country. In the first quarter of 1922, the total British sales, *plus* the German imports, amounted to 111,892 gross, which was about the same as in the first quarter of 1920. As the German imports had largely increased, it was apparent that the British trade had suffered considerably from this competition.

Sir JOHN BARRAN had been over witness' Earlsfield factory, which he understood was built by German capital before the war and equipped and managed by Germans, and therefore represented before the war, presumably, as good an example of what could be done by German methods and German system. He would like to have the figures of the cost of production at this factory before the war.

Witness rather thought the Germans took away or destroyed the records. Continuing, he said that none of the subsidiary companies, to which reference had been made, were included in the present complaint. At the present time it was impossible to buy raw materials cheaper in Germany than in this country, because the German Convention made the Export Commission keep up the price of raw materials to the British manufacturers. There was a large stock of German thorium in this country. This came in prior to the passing of the Act. There was also a large stock of American thorium. Rings were not coming in to any extent. Generally speaking, the Germans were seeing to it that we did not get cheap German raw materials.

Answering Mr. PUGH as to the manufacture of thorium nitrate in this country, witness intimated that a factory had been erected by the South Metropolitan Gas Company during the war where the raw material used was crushed rock from Colombo which had a very low thorium content. This factory, however, produced thorium nitrate at a wholly preposterous price; and at one time the only stock in the country was the stock held by this Gas Company. They charged 90s. per kilo (quite rightly), which was 4½ times the pre-war price. Immediately it was known that thorium and cerium were scheduled to the Act, the Americans and Germans sent in enough to this country to last for 2½ years. He did not think there was any chance of the Germans again getting a monopoly of raw materials; but they would be able to get a monopoly of the mantle trade if they could kill the British industry. The subsidiary companies had spent £50,000 or £60,000 in experimental work over a period of 3½ years.

Mr. *Benjamin Bark* (Manager of the Welsbach Company's factory at Wandsworth since 1909) said that when the Germans owned the factory he went several times to Germany and studied their methods. There was little to choose between the British and the German factories. Indeed, during the time the Germans owned the factory the question was discussed whether the Wandsworth factory should not execute all orders for America because manufacture was cheaper here than in Germany. Another instance of our methods being in advance of the German was in connection with this matter, because in the discussion as to what the English factory should receive in the event of this plan being adopted, he had been able to show the Germans that their methods of calculation were wrong. Again, between 1911 and 1914, differences arose between himself and the D.G.A.—the German concern—as to the effectiveness of certain of the Welsbach Company's methods of washing fabric, as compared with those obtaining in the German factory. After a very lengthy investigation, the German Company admitted that the English methods were the correct ones. In consequence of the imports of German mantles, the number of mantles manufactured by his Company last year was little more than one third of the quantity made in 1919, and the number of workers was about one-third of the normal, while those remaining were on short time. To meet the anticipated requirements of post-war trade, the Welsbach Company built and equipped an extension of their factory in 1919-20 at a cost of £18,000.

Answering questions by the Committee, witness pointed out that in 1914 wages were about the same here as in Germany. Up to 1919, the Company thought they would be able to maintain the business they were doing before German importation began (not the same trade as was done during the war); and there was some understanding that assistance would be given to this end by the Government.

Mr. *Louis Bruell* (Manager of the mantle department of Messrs. Falk, Stadelmann, & Co., Ltd.) stated that from 1906 until 1914 his Company took the whole of the output of the factory of the British Incandescent Mantle Works, Ltd.—a Company owned by the principal German mantle manufacturers. This factory was at Earlsfield, and was laid out and equipped upon the most approved and up-to-date continental methods. After the outbreak of war, it was sold by the Public Trustee to Curtis's & Harvey, and was now operated by them as a mantle factory. His Company then decided to erect a factory for manufacturing their own mantles. They did so on very similar lines to the one that had been sold; and he claimed that the mantles produced at that factory to-day were better than those produced in former years by the factory under German management. Before the war, German mantles sold in this country at from 11s. to 25s. per gross—the former being a dumping figure; the Germans recouping themselves by the profit on the higher price. In Germany, at the same time, the price was higher—viz., 20s., corresponding to the 11s. in this country. He was continually receiving reports from his travellers that German mantles were being sold here at from 20s. to 34s. per gross. He handed in a mantle bought in Peckham at 8½d. retail from a shipment purchased at 28s. per gross. This was dearer than the British article; but the dealer was willing to push the sale of it because of the larger profit. For the 5½d. mantle sent out in England, the dealer paid 50s. per gross, which was just below the cost of production. Other mantles had been offered him at 30s. per gross; and they would probably be bought at 25s. Again, offers had been made at 34s. when the German official price was 46s. 6d. Taking the rate of exchange as it stood in January, there were large imports here at 26s. per gross; and 60 p.ct. of the German exports came to this country. Many mantles were imported here in plain boxes and then given labels with English lettering, conveying the impression that they were made in England. Several samples were shown the Committee.

Mr. *Albert Thomas Metcalfe* (Secretary of Lighting Trades, Ltd.) spoke of an offer from a Herr Fraenkel (proprietor of the Mammoth gas-mantle works of Berlin) to supply mantles—half the order at the convention price and the other half invoiced as seconds, at 21s. 7d. per gross, the remainder at 43s. 2½d., bringing the average price down to 32s. per gross. It was clearly indicated that the goods invoiced as seconds would be the same as the others. This would give a price of about 2d. each; and that mantle was being sold at 7½d. retail.

Mr. *J. T. Robin* (Managing Director of J. T. Robin, Ltd.) represented one of two firms who did nothing else but make mantles. Most of the other mantle manufacturers dealt in other things—such as burners, glassware, &c. He expressed the belief that the Germans would make another attempt to set up the international trust scheme put forward in 1914; and there would be nothing to prevent its being forced on the British manufacturers if the present conditions continued. Before the war, subject to getting his thorium supplies at the same price as the German manufacturers, he could produce mantles in this country as cheaply as could be done in Germany. The difference between British and German costs translated into sterling was due to the depreciation of the mark, and particularly in consequence of the difference between the internal and external values. During 1919, he employed 500 men; but at the present time he was employing only 50. He had several million mantles in stock, and was not prepared to manufacture further quantities until these were disposed of. As a matter of fact, before the war his factory was producing mantles at 3s. per gross less than the Germans; the reason being that at that time labour was actually cheaper here than in Germany. As showing that British methods were as good as, or even better than, the German before the war, he mentioned that the Auergesellschaft purchased machines from him for making mantles, and for some years paid royalties on the machines based on the savings made. In order to arrive at the royalties, he had to have particulars of the wages paid; and the figures showed that we were paying rather less. The Customs returns revealed the fact that mantles were being sent here below the Convention prices, because although the manufacturers were willing to send in invoices marked with the Convention prices, they were not willing to declare the goods at a higher price than was actually being received because of the Reparations duty. If it were not for that, it was probable that the returns would show all German mantles coming in at one fixed price.

Sir JOHN BARRAN put some questions as to the reason why the proposed international trust came to nothing in 1914.

Witness said it was not due to the war. The Germans were endeavouring to get his business. He, however, made it a condition that manufacture should be transferred from Germany to this country; and the Germans decided that this would leave them with too much plant unused, and that it would hardly pay them to do it. Generally speaking, he did not believe the German industry was in any better condition than the British, if it were not for the depreciated mark.

Evidence was then called from two representatives of the workers in the industry in support of the application—one representing the women workers and one the men workers. It was pointed out that 95 p.ct. of the operatives in the industry were women, and that a very large proportion were now either unemployed or on short time. It was said that about one-third of the total workers only were now employed, and that there have been large dismissals from the thorium, ramie, and magnesia ring factories in consequence of the slackness in the mantle trade. These witnesses also made the complaint that German mantles are usually sold in boxes got up like British mantle boxes with misleading titles, at prices just below the prices of English mantles.

This closed the case for the complainants.

Mr. KENNETH SWAN then briefly outlined the case for the opposition, and asked for an adjournment in order that he might prepare his case more thoroughly, as he had little information as to the case he had to meet until he came to the inquiry. The vital point with which the Committee were concerned had not been touched upon in the evidence, the bulk of which had been directed to satisfying the Committee that German mantles were coming into this country at prices which competed seriously with British prices. This might be so; but that was not the question which the Committee had to consider or determine at all. The Act was not a protective measure, but was directed against two quite specific evils—first, dumping, and they were not concerned with that because the complaint was not in regard to dumping. It was directed against the specific point, which was the second object of the Act—that the prices at which German goods were

coming into the country were low on account of the depreciation of the German exchange. This needed very careful consideration, and such evidence as had been tendered of small parcels of goods, which might or might not be the same quality goods as the higher-priced ones, being sent into this country at low prices, required to be considered as regarded identical types of goods. They could not deduce what was the manufacturing cost by taking an average price; and it was essential to compare the identical article in both cases. He would confine his evidence to the examination of mantles that were similar in character and in quality. Then there was the question, which was more or less *sub judice* at the moment, of the interpretation of the Referee's decision as regards gas-mantles under Part I. The Customs authorities, although in some doubt whether they should value the mantle at its ash value or the total value, had determined temporarily to assess it at the total value. This was the present position; and it might be the permanent position for some time to come. Counsel handed in a letter from the Board of Customs which he suggested bore out this statement.

Sir JOHN BARRAN suggested that this letter did not mean that a decision had been come to, but that the Board of Customs, in order to safeguard themselves, had assumed that the higher rate was the right one. It simply meant they would take the money on deposit and hold it.

Mr. SWAN said he did not intend to put it any higher than he should. Anyway, it was a basic fact which had to be taken into account in ascertaining the actual value at which the German mantles would be marketed in this country. That price had to be compared not with the price at which a corresponding mantle was manufactured in this country, but the price at which it could profitably be manufactured. He suggested that the Committee should make a very careful scrutiny of the figures that were to be disclosed to them confidentially—first of all to ascertain that these figures appertained to the same type of mantle, and also to see how much was attributable to wages, overhead charges, and so on. He would call evidence from Germany which would show clearly the analysis of the costs in this way in Germany, so that the Committee would be able to compare the two. He believed it would be found that the labour costs were lower in Germany, and that the raw material costs were slightly higher, but that taking the two items together they were substantially the same. There might be a slight balance in favour of the German manufacturer after taking into account the internal value of the mark. Then there was the question of overhead charges and the question of what was a reasonable profit, because, according to the Act, the cost was the cost including a reasonable profit. In this connection there was the question of whether the capital embarked in this industry was a reasonable capital having regard to the turnover and the scale of the industry. He thought it would be found when the two sets of figures were compared that the overhead charges in England were considerably greater than the German overhead charges, and that it was this fact which enabled the German manufacturer to send goods more cheaply to his home market than he chose to send them to this country. None of this, however, was the subject of the complaint in this case. The complaint was solely that it was the depreciation of the mark. He would call evidence from German manufacturers on this point, including the President of the German Convention. But even if the Committee found that competition was due to the depreciated exchange, they still had to find another fact, which was that employment in the United Kingdom was being, or was likely to be, seriously affected thereby. The figures in the original statement of the complainants showed that there had been a decline in British manufacture far in excess of any increase in the German manufacture. Whereas the German import rose from 1920 to 1921 from 40,000 to 60,000 gross, there was a decline in British manufacture of something like 160,000 gross. He was the first to deplore the unemployment which had unfortunately arisen from the decline in the manufacture of British mantles; but the Committee had to determine whether this was due to German competition, or to a natural decline in trade or other causes—such as the overstaffing of British works when it was thought there was going to be a tremendous boom in 1919, and that no end of mantles would be sold.

The inquiry was then adjourned until Monday, June 19. It is hoped to conclude on Wednesday, June 21.

New Companies.—The Calder Carbonizing Company has been registered as a private company, with a capital of £3500. The offices are in Victoria Street, Sowerby Bridge. Another private company recently registered is the Carbide Corporation, with a capital of £1000, and offices at No. 15, Victoria Street, Westminster, S.W. Economic Gas Traction has been registered, with a capital of £40,000, to carry on the business of engineers, &c. The office is at No. 82, Victoria Street, S.W.

Money for Gas-Cookers.—It was reported to the Ellesmere Urban Council last week that, in reply to a letter from the Council with regard to the proposed borrowing of £100 for the purpose of purchasing 20 gas-cookers, to be fixed in the Council houses, the Ministry of Health said they were advised the Council had no power to borrow for this purpose under this Order. It was suggested that the Council might allow the tenants to arrange for the provision and fitting of the cookers at their own expense. If, however, the Council found this course impracticable, the Department would be willing to consider an application for sanction to a loan under the Housing Act. The Clerk said he had since received sanction for power to borrow the money for a period of ten years.

Reductions in Wages and Salaries at Newtown.—The Newtown Urban Council have adopted a recommendation of the Finance Committee that the salary of the Gas Manager (along with those of several other officials) be reduced by 10 p.ct. A protest was made by Mr. Martin Woosnam, on the ground that the Council and the officials had entered into a contract which could not be altered, except by mutual consent. The Gas Committee, at the same meeting, recommended that the wages of the stokers at the works should be reduced 5s. a week on July 1, 5s. on Sept. 1, and 5s. on Nov. 1. It was decided to adopt the recommendation with the amendment that a reduction of 5s. be made in July, and a further 5s. in October; and that the whole question be reviewed next year.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *June* 12.

In the London tar products market there is a good deal of inquiry for pitch for next season's shipment, and the price is from 70s. to 72s. 6d. per ton net in bulk at makers' works. The recent demand for creosote has strengthened the position of this article, and the price is firm at 6¼d. to 6½d. per gallon net at makers' works for bulk business. As is usual at this time of the year, the chief activity is in road tar, and the fine weather is stimulating the demand. Other tar products remain without change.

In sulphate of ammonia, the export market is chiefly absorbing supplies.

Tar Products in the Provinces.

June 12.

There has been considerable activity in pitch during the past week, and in spite of the warm weather a quantity has been sold for shipment over the next two or three months. Inquiries have come from all markets, so that it would appear that the rise is a genuine one. For the forward position consumers are inquiring, and are inclined to cover a portion of their requirements even at the advanced prices.

As regards other coal tar products, there is little to report.

The average values for gas-works products during last week were: Gas-works coal tar, 38s 3d. to 43s. 3d. Pitch, East Coast, 67s. 6d. to 70s. f.o.b. West Coast—Manchester, 65s. to 67s. 6d.; Liverpool, 65s. to 67s. 6d.; Clyde, 67s. 6d. to 68s. 6d. Benzole 90 p.ct. North, 2s. 1d. to 2s. 2d.; crude 65 p.ct. at 120° C., 1s. 5d. to 1s. 7d. naked at makers' works; 50-90 p.ct., naked, North, 2s. 1d. to 2s. 2d. Toluole, naked, North, 2s. 2d. to 2s. 5d. nominal. Coal tar crude naphtha in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 2s. to 2s. 2d. Heavy naphtha, North, 2s. 1d. to 2s. 3d. Creosote, in bulk, North, liquid, 4⅛d. to 4⅜d.; salty, 4⅛d. to 4⅜d. Scotland, 4d. to 4⅛d. Heavy oils, in bulk, North, 6d. to 6½d. Carbolic acid, 60 p.ct., 2s. to 2s. 1d. Naphthalene, £12 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 5d. to 6d. per minimum 40 p.ct.; "B" unsaleable.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

With many of the works shut down for the Whitsun holidays, there is no great change in these materials since the last report. Pitch remains steady, and sales continue to be made for next season's delivery, though the hot weather is affecting business. There is no change in quotations. Creosote is firm, and likely to maintain its present value for some time. Stocks are none too plentiful; and there is still evidence of a fair demand. Crude carbolic acid remains as last reported without much further business to the Continent. Cresylic acid is weaker; pale quality being worth 2s. 2d. per gallon, and dark quality 1s. 11d. per gallon. Solvent naphtha remains dull, though probably no worse than when last reported. Consumers in the rubber trade are not buying much at present, and are looking to get their supplies at 1s. 9d. to 1s. 10d. per gallon. The price asked, however, is 2s. to 2s. 1d. Benzole has developed weakness. It would seem that with the output below normal, and the demand for motor purposes fairly high, the supply of petrol is greater. The latest value is 1s. 10d. to 1s. 11d. per gallon. Intermediate products have also been affected by the holidays, since when they have been very quiet. There is small inquiry, however, and only a little business is being done, mostly for the Continent, without change of prices.

Sulphate of Ammonia.

There are no new features to report, except that the lower nitrate prices have induced a slightly lower value for export prices for sulphate of ammonia, which is now in the neighbourhood of £16 10s. per ton. It is now anticipated that new prices for the home trade for the deliveries July and onwards will be announced towards the end of next week.

War Memorial at Kensal Green.—A fine bronze war memorial to the memory of the employees of the Gas Light and Coke Company at the Kensal Green station who fell in the great war was unveiled on Wednesday afternoon, May 17, by the Governor (Mr. D. Milne Watson). The service was conducted by the Vicar of St. John's Church (the Rev. R. Thornber, M.A.), assisted by the choir and the Kilburn Prize Band. After the address, in which the Governor paid grateful tribute to the memory of the fallen heroes, and amid profound silence, the Last Post was sounded. Among many beautiful wreaths laid at the foot of the memorial by the bereaved, a number of whom were present, was the tribute of sympathy placed there by the Governor on behalf of the Directors.

Holsworthy Gas Supply.—Presiding at the annual meeting of the Holsworthy Gas and Electric Supply Company, Mr. J. M'T. Dickson, said there had been a decrease in gas consumption, owing partly to the increase in price from 10s. to 13s. 4d. per 1000 c.ft., and partly to the fact that the District Council last season did not light the public lamps. The Council seemed to take up a very unfriendly attitude towards the Company. At the Council's request, gas-mains were extended for the purpose of public lighting, entailing a heavy outlay; and because the Council objected to the Company's price, they refrained from lighting the lamps. The concern was bought by business men for the benefit of the town when there was a prospect of its getting into the hands of outsiders. It would be a bad thing for the town if the works were closed.

Sidmouth Gas Undertaking.—On the recommendation of the Gas Committee, the Sidmouth Urban District Council have agreed to a reduction of 1s. per 1000 c.ft. in the price of gas, and to purchase a number of new street-lamps, so that the lighting may be efficient next winter. It was also decided to apply for permission to borrow £1950, for new purifiers and a station-meter.

Wellington (Salop) Preference Stock.—With reference to the recent advertisement inviting tenders for 6½ p.ct. preference stock in the Wellington (Salop) Gas Company, we learn from Mr. H. J. Woodfine, the Manager, that the issue was largely over-subscribed, and that the whole of the amount required—viz., £13,500 was allotted at a premium. Tenders at par were therefore unsuccessful.

Blyth Gas Company's Reduction.—The Blyth Gas Company from the June meter readings will reduce the price of gas as follows: Blyth area.—From 1s. to 10 66d. per therm, equal to 4s. per 1000 c.ft. Bedlington area.—From 1s. 1·33d. to 1s. per therm, equal to 4s. 6d. per 1000 c.ft. Prepayment meter consumers in each area will receive a corresponding reduction by the amount of discount allowed being increased. The reduction represents 6d. per 1000 c.ft. under the old method of charging.

Bangor (Carnarvon) Gas Department Loss.—In his report to the Bangor City Council on the past year's working of the Gas Department, Mr. P. F. White (Gas and Electrical Engineer) said the deficiency of £4179 (as compared with a deficiency of £336 for the previous year) was the worst result they had yet experienced, and was due primarily to the disastrous coal stoppage of 1921, and, secondly, to the drop in the price realized for tar. Coal cost £3802 more than in the previous year; while tar fetched nearly £1500 less.

Hereford Gas-Works Plant.—With reference to the proposed borrowing of £12,000 for carburetted water-gas plant at the Hereford Gas-Works, the Gas Committee report that a letter has been received from the Minister of Health stating that, before coming to a decision on the Council's application for sanction for this loan, he will direct a local inquiry to be held on the subject at an early date, and that if the Council decide to proceed with the work before the matter has been fully considered by the Department, they must do so on their own responsibility. The Minister, however, points out that he would not regard the fact that this had been done as, of itself, a reason for refusing to sanction the loan. The Committee propose at once to proceed with the alteration of buildings to house the new plant.

Tully Gas Plants, Ltd., have received a repeat order for one set 500,000 c.ft. installation for Japan.

The Blackpool Gas Committee have decided to allocate their disposable balance as follows: To the rates, £3500; motor renewals fund, £574; and reserve, £3248.

Improvements at the Ashburton Gas-Works were said to be necessary at a meeting of the Urban Council; and it was resolved that permission to raise a loan of £400 be applied for.

The Galashiels Gas Light Company have reduced the price of gas 9d. per 1000 c.ft., making the rate now 4s. 11d. for lighting, less 10 p.ct. for trade and 15 p.ct. for engine purposes. The North Berwick Town Council have lowered their price 5d., to 6s. 0½d., per 1000 c.ft.

The Todmorden Corporation have approved a reduction in the price of gas for motive power from 6s. to 5s. per 1000 c.ft., and for ordinary lighting from 6s. 8d. to 5s. 8d., with 12½ p.ct. discount for payment within a month. The Keighley Gas Committee propose that the Town Council should authorize a reduction in the price of gas of 5d. per 1000 c.ft. The present price is 3s. 9d.

Gas Department lamplighters at Bradford number 168, of whom 53 are involved in a decision to continue public lighting restriction for a further period of two months. The Gas Committee have urged the Finance Advisory and Co-Ordination Committee of the Corporation to allow supplementary estimates, to enable any Corporation Committee to find employment during this period for men displaced owing to the lighting restrictions.

While bathing in the Thames near Maidenhead Bridge, a Mr. Gourlay got into difficulties through the suction of a barge, and disappeared. His friends could not reach him; but Mr. E. Wood, Assistant Manager at the Maidenhead Gas-Works, dived from a wall, and made a gallant attempt at rescue. He recovered Mr. Gourlay; but artificial respiration failed, life being extinct. A witness spoke in the highest praise of Mr. Wood's efforts at rescue; and the Coroner also highly complimented him.

Messrs. A. & W. Richards have been instructed to offer for sale by tender a new issue of £26,000 of 6 p.ct. redeemable preference stock (or such amount as will produce the net sum of £25,000) in the Rugby Gas Company. The minimum price of issue is £97 per £100; and the stock is to be redeemed at par on July 1, 1932. Tuesday morning, June 20, is the latest time for tenders to be sent in. Part of the new issue is rendered necessary by the Company's constantly growing business; and part is to pay off an existing bank loan.

Interesting questions were lately raised in the Blackburn Town Council arising out of the recent exhibition held under the auspices of the Gas Committee. Mr. Hamer, J.P. (Chairman of the Committee), said all the expenses of the exhibition were met by the rentals paid by the exhibitors; and there was a satisfactory balance of £60 on the right side. The Blackburn Master Plumbers did not contribute financially towards the exhibition, or assist in any way to its success. During the exhibition 102 cookers, 52 grillers and other small appliances, and 50 fires, boilers, and geysers were sold. The Master Plumbers received 10 p.ct. on fires, boilers, and geysers only and not on all the gas appliances sold. A plumber was not only paid for installing the goods named, but also received the 10 p ct. commission, even though he had been in no way responsible for their introduction. The matter was certainly one which might be gone into,

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STOCK MARKET REPORT.

THE Stock Exchange has had anything but a pleasant week of business. Happily it was a short one; Monday being the Whitsuntide closure. The terrible condition into which Irish affairs have drifted, coupled with futile conferences over European questions, produced a feeling of actual depression which affected the whole House in general. Selling, in order to get out, was the word in pretty well every market.

The gilt-edged department felt it as much as any. Home Government issues fell progressively; and on Friday the big four's figures were: Consols 55⅜-56¼, War Loan 99 1/16-99⅜, Funding 84⅜-85¼, Victory 87¼-88½. Indians had a fall. Home Rails were flat, a good deal of profit-snatching being done. Canadians and Argentine were very dull.

The Foreign Market, as might be expected, was weak; French, Brazilian, Chinese, and Japanese being conspicuous.

In the Miscellaneous Market, Rubber was quite out of favour; but Oil was fairly steady, and Iron and Steel, on the chance of industrial peace.

Business in the Gas Market was well up to the mark in point of activity, and was immune from the depression gloom brooding in other quarters. The general tendency was very firm, and further advances in quotations—some of them being of remarkable magnitude—were recorded. The London Companies' issues were all very firm, except Gas Light preference, which had rather overshot the mark. The Suburban and Provincial were again conspicuous. Hornsey rose 15, Plymouth and Stonehouse 27½, Southampton 7, and Newcastle ⅜. In the Continentals, European fell ½, and Malta and Mediterranean rose ½. Imperial Continental and Primitiva remain unchanged, being little dealt in.

The following transactions in gas during the week were recorded: On Tuesday, Aldershot 4 p.ct. preference 73½, Brighton and Hove "A" 121, 122, Continental Union 40, European 12⅞, 13, Gas Light ordinary 95, 95½, 95⅝, 95¾, 96, 96¼, ditto maximum 65, 66, ditto debenture 65½, Imperial Continental 164, 165½, Primitiva preference 45s., ditto 1911 debenture 57, 57½, South Metropolitan 96½, 96¾, 97, 97½, ditto 6½ p.ct. debenture 105½, Liverpool 7 p.ct. preference 106½, 107. On Wednesday, Brentford "A" 93½, ditto "B" 92, Brighton and Hove original 170, ditto "A" 122, British 30, Commercial 3½ p.ct. 93, 95, Derby 83⅜, 84½, European 13, Gas Light ordinary 95¼, 95½, 95⅝, 96, ditto maximum 65¼, ditto preference 81½, ditto debenture 63, Imperial Continental 164, Primitiva preference 45s., 46s., South Metropolitan 96½, 96⅝, 97¼, Tottenham "A" 114, 115⅜, ditto "B" 99⅜, 100, 100½, 101, Croydon 5 p.ct. maximum "D" 77, 77½, Hornsey 10 p.ct. 154, 155. On Thursday, Bombay 4⅞, Brentford "B" 92½, Brighton and Hove "A" 120, Commercial 4 p.ct. 93, 94, ditto 3½ p.ct. 93½, 94½, Gas Light ordinary 94⅜, 95, 95¼, 95⅜, ditto preference 78½, 79, Imperial Continental 164, 164½, South Metropolitan 96½, 96⅝, 97, 97¼, ditto 6½ p.ct. debenture 105⅝, South Suburban 100, 100½, Tottenham "A" 115, Liverpool 7 p.ct. preference 107¼, Swansea 6½ p.ct. debenture 105 1/16, Newcastle 84, ditto 4 p.ct. preference 69, 71, Barnet "A" 116½. On Friday, Aldershot 4 p.ct. preference 73½, Brentford "B" 92, 92½, Brighton and Hove "A" 122, Commercial 4 p.ct. 92, European 12⅛, 12¼, 12⅜, 13, Gas Light ordinary 94⅜, 94⅝, 95, 95¼, 95½, ditto debenture 63, 65, 65⅜, Imperial Continental debenture 79, South Metropolitan 97⅛, 97¼, Tottenham "B" 101, Swansea 7 p.ct. preference 101½.

In the Money Market, the opening presented some prospect of easier conditions, but nothing came of it, and rates became firm and so continued to the close. Discount terms remained steady. The Bank rate is 4 p.ct., as fixed on April 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Mch. 15	4	4%	Aldershot 4 p.c. Pref. .	..	70—75	73½
1,551,868	,,	Apl. 12	2½	3 1/18%	Alliance & Dublin Ord.	59—64	62—67	...
374,000	,,	Jan. 12	4	4%	Do. 4 p.c. Deb.	76—79	62—67	...
280,000	5	May 18	7½	4/-	Bombay, Ltd. . . .	5¼—6¼	4¾—5	4⅞
100,000	5	Feb. 23	16	7½%	Bourne-mouth Gas and Water { 5 p.c. . .	..	10½—11½	...
383,110	10	,,	7	7%	B 7 p.c.	15—15½	9—10	...
115,000	10	,,	6	6%	Pref. 6 p.c.	13¾—14	8—9	...
162,065	—	Dec. 30	—	4%	4 p.c. Deb.	..	65—70	...
992,045	Stk.	Feb. 9	14	56/-	Brentford A Consolid. .	261—266	88—93	93½
734,920	,,	,,	11	55/-	Do. B New . . .	204—209	88—93	92—92½
55,000	,,	,,	5	5%	Do. 5 p.c. Pref. .	109—111	80—85	...
221,400	,,	Dec. 15	4	4%	Do. 4 p.c. Deb. .	91—93	75—80	...
214,775	,,	Mch. 15	11	11½%	Brighton & Hove Orig. .	208—213	165—170	170
244,200	,,	,,	8	8½%	Do. A Ord. Stk.	154—159	118—123	120—122
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max. . .	..	..	
530,000	20	Mch. 15	12½	10%	British	44—45	29—31	30
120,000	Stk.	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	78—82	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	55—60	...
100,000	10	June 1	—	7%	Cape Town & Dis., Ltd.	1½—2½	6¾—7¾*	...
100,000	10	Apl. 27	—	4½%	Do. 4½ p.c. Pref. .	4—6	5¼—6¾	...
100,000	Stk.	Dec. 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	75—80	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord. . .	108—110	..	...
1,513,280	,,	Mch. 15	5/9/4	42/8	Commercial 4 p.c. Stk.	106—108	91—96	92—94
560,000	,,	,,	5½	38/4	Do. 3½ p.c. do.	103—105	92—97	93—95
475,000	,,	,,	3	3%	Do. 3 p.c. Deb. Stk.	69½—73½	57—62	...
800,000	,,	Dec. 15	4	—	Continental Union, Ltd.	76—79	37—42	40
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	55—60	...
51,600	,,	Feb. 23	15	15%	Croydon A 10 p.c. . .	..	200—210	...
278,400	—	,,	12	12%	Croydon B and C 7 p.c.	..	160—170	...
492,270	Stk.	—	6	4½%	Derby Con. Stk. . .	123—125	80	83¼—84¼
55,000	,,	—	4	4%	Do. Deb. Stk. .	102—104	65	...
1,002,180	10	Jan. 26	10	5/0	European, Ltd. . . .	17½—18	12½—13½	12½—13
16,298,975	Stk.	Feb. 23	4/17/4	46/8	Gas Light and Coke { 4 p.c. Ord . . .	98—102	94—97	94¾—96¼
2,600,000	,,	,,	3½	35/-	3½ p.c. max. . .	76—79	65—68	65—66
4,062,235	,,	,,	4	4%	4 p.c. Con. Pref.	96—99	78—81	78½—81½
4,674,850	,,	Dec. 15	3	3%	3 p.c. Con. Deb.	72½—74½	63—66	63—65¾
130,000	,,	Dec. 11	10	10%	10 p.c. Bonds .	..	..	...
82,500	,,	Sept. 14	5	3½%	Hastings & St. L. 5 p.c.	..	..	...
258,740	,,	Mch. 15	3½	2½%	Do. 3½ p.c.	87—89	52—57	...
70,000	10	May 18	11	5%	Hongkong & China, Ltd.	16¼—16½	6—7	...
86,600	Stk.	Mch. 15	9	9½%	Hornsey 7 p.c. . . .	..	115—120	...
131,000	,,	,,	7½	7½%	Ilford A and C . . .	151—154	120—130	...
65,780	,,	,,	6¾	5¼%	Do. B.	115—118	100—110	...
65,500	,,	Dec. 30	4	4%	Do. 4 p.c. Deb. . .	92—94	75—80	...
1,976,000	,,	May 18	9	5%	Imperial Continental .	150—160	162—167	164—165½
404,800	,,	Feb. 9	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	75—80	79
235,242	,,	Mch. 15	6¼	6¼%	Lea Bridge Ord. 5 p.c.	119—121	83—88	...
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. { A.	211—213	..	...
					B.	146—148	..	...
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	..	...
165,736	,,	Feb. 23	7/5/6	6%	Maidstone 5 p.c. . .	..	80—85	...
63,480	,,	Dec. 30	—	3%	Do. 3 p.c. Deb . .	..	48—51	...
75,000	5	June 11	6	3%	Malta & Mediterranean Met. of Melbourne { 4½ p.c. Deb.	4¼—4¾	3¼—3¾	...
250,000	100	Apl. 3	4½	4½%		99—101	91—98	...
541,920	Stk.	June 1	4	4%	Monte Video, Ltd. . .	11½—12	63—68*	...
1,875,892	,,	Feb. 23	4¼	4¼%	Newcastle & Gatsh'dCon.	98½—99½	83¾—84¼	84
529,705	,,	Dec. 30	3½	3½%	Do. 3½ p.c. Deb.	82—83	69—71	...
15,000	10	Aug. 26	—	7/6	North Middlesex 10 p.c.	..	12¼—13	...
55,940	10	Mch. 15	7/14/0	10/1⅜	,, ,, 7 p.c.	14—15	10¼—11¼	...
300,000	Stk.	May 18	8	8%	Oriental, Ltd. . . .	117—122	90—95	...
60,000	5	—	10	—	Ottoman, Ltd. . . .	7¼—7¾	2—3	...
188,120	Stk.	Dec. 30	—	6%	Plym'th & Stonh'se 5 p.c.	..	95—100	...
60,000	50	Mch. 15	13	62/6	Portsea Island, B . .	128—131	87—90	...
100,000	50	,,	12	57/6	Do. C . .	118—121	78—83	...
249,980	5	,,	8	—	Primitiva Ord. . . .	5½—6	⅞—1	...
499,960	5	—	5	—	Do. 5 p.c. Pref. .	4½—5	2¼—2¾	45/—46/-
521,600	100	June 1	4	4%	Do. 4 p.c. Deb. .	91—93	68—73*	...
600,000	Stk.	Jan. 26	4	4%	Do. ,, ,, 1911	..	55—60	57—57½
346,198	,,	Dec. 30	4	4%	River Plate 4 p.c. Deb.	85—87	55—60	...
150,000	10	Mch. 30	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	5¾—6¼	...
125,000	50	Jan. 3	5	5%	5 p.c. Deb.	47—49	36—39	...
135,000	Stk.	Mch. 15	10	5%	Sheffield A	223—224	89—92	...
209,984	,,	,,	10	5%	Do. B	222—224	89—92	...
523,500	,,	,,	10	5%	Do. C	220—222	89—92	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c. . .	..	..	...
90,000	10	Oct. 28	9	8%	South African . . .	10½—11½	7—9	...
6,609,895	Stk.	Feb. 9	5/4/0	5%	South Met. Ord. . . .	111—113	95—98	96½—97½
250,000	,,	Jan. 12	—	5%	Do. Red. Pref. .	..	96—98	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb. .	72½—74½	60—63	...
224,820	,,	Feb. 23	8½	8½%	South Shields Con. Stk.	157—159	106—108	...
1,087,795	,,	,,	6	5½%	S'th Suburb'n Ord. 5 p.c.	114—116	98—103	100—100½
368,837	,,	Dec. 30	5	5%	Do. 5 p.c. Deb. Stk.	116—118	95—100	...
647,740	,,	May 18	5	5%	Southampton Ord. . .	99—102	70—75	...
121,275	,,	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	..	60—62	...
120,000	,,	Feb. 23	—	7½%	Tottenham { A 5 p.c. .	135—138	112—117	114—115½
782,275	,,	,,	6	5½%	District { B 3½ p.c. .	115—117	98—103	99½—101
181,255	,,	Dec. 15	4	4%	4 p.c. Deb.	87—89	77—82	...
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1¾—2	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
236,476	Stk.	Mch. 15	5	3½%	Tynemouth 5 p.c. max.	108½—109	71—73	...
30,000	,,	Mch. 15	8½	66/3	Wandsworth, Wimbledon, and Epsom— Wandsworth A 4 p.c. .	151—156	110—115	...
255,636	,,	,,	6¾	51/3	Do. B 3½ p.c. .	129—134	95—100	...
108,075	,,	,,	—	46/4½	Do. C. . . .	..	85—90	...
140,865	,,	,,	—	46/4½	New Ordinary . . .	..	85—90	...
352,000	,,	,,	6½	45/-	Wimbledon 5 p.c. . . .	117—122	90—95	...
98,000	,,	,,	6¾	50/-	Epsom 5 p.c. . . .	121—126	93—98	...
88,416	,,	Dec. 30	3	3%	3 p.c Deb. Stk. . .	66—69	57—60	...

* Ex Div.

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By order,
J. FEARNLEY.
Town Clerk.

Town Hall,
Birkenhead,
June 7, 1922.

Continued on p. 646.